ELECTRICAL TIMES

The season's greetings from AEI *Cable Division*

Photograph by courtesy of British Railways

Hackbridge PVC sheathed cables defy corrosion

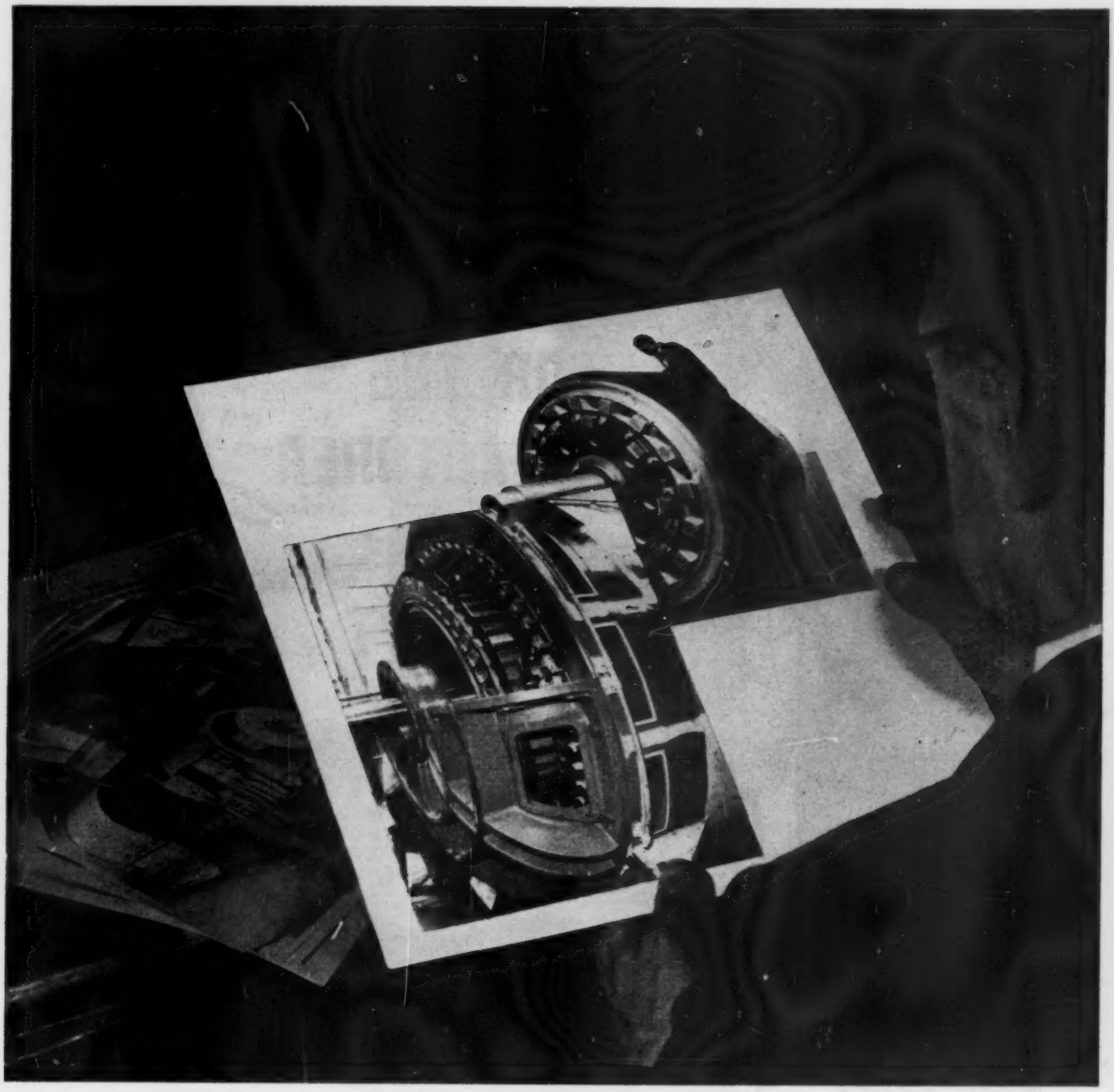
Corrosion is a constant menace in many industries and a really serious problem where it endangers the high safety factor called for in the railway field. The service life of conventionally served cables is limited if exposed to corrosive agents but Hackbridge P.V.C. sheathed cables are especially designed to resist attack from oils, acids and alkalis. P.V.C. sheathing can be provided on all power and communication cables giving a flexible, yet mechanically strong, covering which will not support combustion.

HACKBRIDGE CABLES

HACKBRIDGE CABLE COMPANY LIMITED

KELVIN WORKS, HACKBRIDGE, SURREY
TELEPHONE FRAnklin 1101/7

Broadway/h12c



"That's worth a page in the *Electrical Times*—the largest a.c. commutator motor ever made anywhere, to the best of our knowledge."

("And since it isn't everyone who is concerned with thousands of horse-power, we'll add a note about N-S variable-speed a.c. motors being available from one horse-power upwards, for hand regulation or almost any desired type of automatic control, details being given in Publication 31/SP")

LAURENCE, SCOTT & ELECTROMOTORS LTD.

Specialist Makers of Electric Motors and Control Gear since 1883 NORWICH

FOR THE MANUFACTURER WHO DOESN'T KNOW...

- Large differential to avoid rapid cycling — approximately 18°F (10°C.)
- Nominal temperature range 100°F (55°C.)
- Standard unit set to switch off at top point of scale — approximately 150°F (65°C.)

. . . that the Sunvic TA. 1 Thermostat is the most reliable and adaptable unit of its kind. Already used by most convector manufacturers today, the TA. 1 Thermostat is also ideal for fan heaters, heating cabinets, and similar equipment. It operates on the self-heat principle, and has a wide bimetal fully exposed to the air stream. The snap-action micro-switch—rated at 15 a. 250V A.C.—has large silver contacts to ensure low contact resistance and long life.

Write for Publication 3012.

AEI

Instrumentation Division
P.O. Box 1 · Harlow · Essex · Harlow 25271
Associated Electrical Industries Limited

SC/301

SENSIBLE SAFETY

Everybody understands why dangerous animals have to be kept behind bars, and so instances of people being injured by caged wild animals are fortunately rare.

Moving machinery and tools can also inflict serious injury, and it is no less important that these, too, should be securely guarded and fenced.

Safety First with

'HARCO' MACHINERY GUARDS

'Harco' Machinery Guards are purpose made for every type of machinery, and are constructed to afford complete protection without interfering with efficient operation. They are strongly made from stout wire mesh to withstand vibration and rough treatment, and all 'Harco' Guards fully conform to Factory Act requirements. The complete Harvey service covers advice, design and installation, and List No. 996 shows many types already supplied.

HARVEY FACILITIES AND PRODUCTS

CLASS I WELDED PRESSURE VESSELS TO LLOYD'S AND A.S.M.E. CODES · HEAT TREATMENT AND RADIOGRAPHY · 'ROTARPREST' HEADS FROM 5 FT. TO 15 FT. DIA.—*Larger sizes to specification* · WELDED PRESSURE VESSELS AND FABRICATIONS IN ALL METALS STEEL PLATE AND SHEET METALWORK HEAVY MACHINING AND FITTING PERFORATED METALS · WOVEN WIRE WIREWORK · STEEL STORAGE EQUIPMENT

HARVEY

G. A. HARVEY & CO. (LONDON) LTD., WOOLWICH ROAD, LONDON, S.E.7

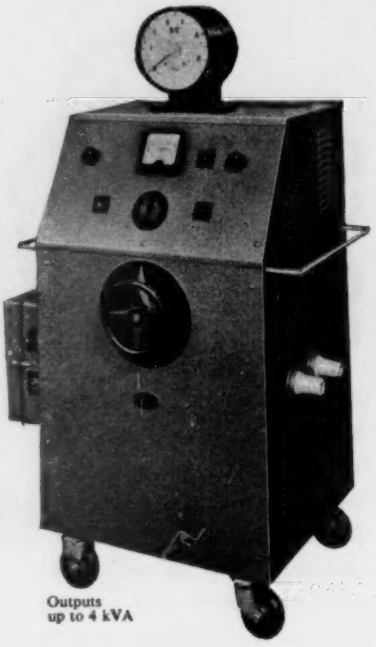
Telephone: GREenwich 3232 (22 lines)

WW/1

ZENITH

Insulation Flash Test Sets

with * "VARIAC" primary control providing continuous regulation of the H.T. voltage down to zero. Voltages up to 30 kV.



Outputs up to 4 kVA

On the left is our standard portable type with safety retractable test prods : models for 2,000 volts and 4,000 volts are usually in stock and special models for higher voltages are designed to order. Mobile sets as illustrated on the right are designed for the flash testing of equipment such as traction motors : a controller-type voltmeter is fitted, the large scale being visible when the test piece is not immediately adjacent.

* Regd. Trade Marks

Our catalogue FT.2 is available on request

THE ZENITH ELECTRIC COMPANY LTD.

ZENITH WORKS, VILLIERS ROAD, WILLESDEN GREEN, LONDON, N.W.2

Telephone: WILlesden 6581-5 Telegrams: Voltaohm, Norphone, London

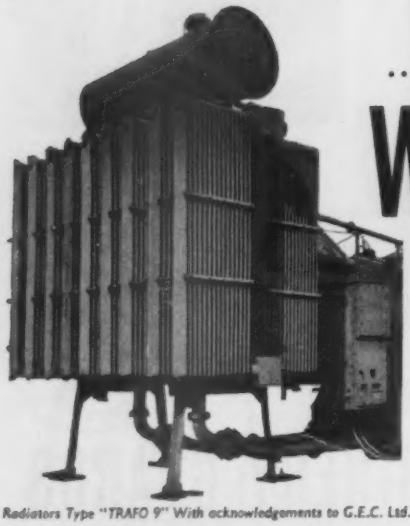
MANUFACTURERS OF ELECTRICAL EQUIPMENT INCLUDING RADIO AND TELEVISION COMPONENTS

...Proved in Service

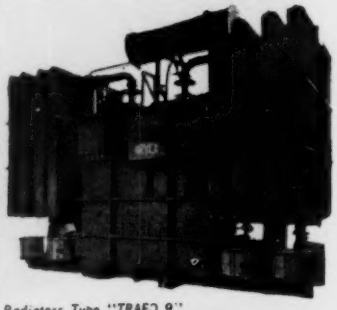
WASHINGTON

COOLING RADIATORS

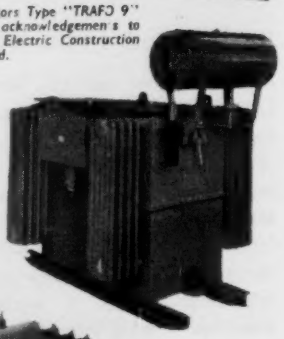
FOR TRANSFORMERS RECTIFIERS AND REGULATORS



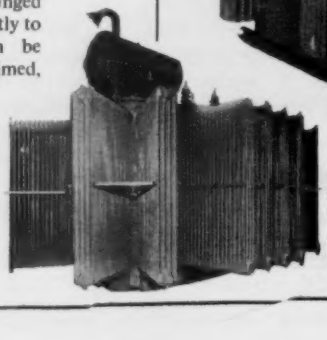
Radiators Type "TRAFO 9" With acknowledgements to G.E.C. Ltd.



Radiators Type "TRAFO 9" With acknowledgemen s to Bryce Electric Construction Co. Ltd.



Radiators Type "TRAFO 858" With acknowledgements to Sturdy Electric Co. Ltd.



Radiators Type "TRAFO 9" With acknowledgements to C. A. Parsons & Co. Ltd.

Washington Transformer Radiators are made to any size with either flanged couplings or for welding directly to the tank wall. They can be delivered phosphated and primed, finish painted or galvanized to meet specific needs. Their design allows free air passage at top and bottom of radiator and makes them suitable for air-blast from underneath. Further details on request.

WASHINGTON ENGINEERING LIMITED

WASHINGTON • CO. DURHAM • ENGLAND.

Tel: Washington 2362/3 Grams: Wearco, Washington Station

BOXES AND CLAMPS FOR M.I.C.C. CABLE

CABLE CLAMPS

Cable clamps are suitable for single or twin-core mineral insulated copper covered cable 0.0015 to 0.003 cross-sectional area.

List No. 901—single entry cable clamp.

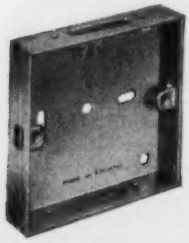
List No. 902—double entry cable clamp.

MK have introduced a new range of boxes and clamps for MICC cable. Single or double entry clamps are interchangeable with any of the boxes and are supplied separately with fixing screws and shakeproof washers. Steel boxes and cable clamps are zinc plated.

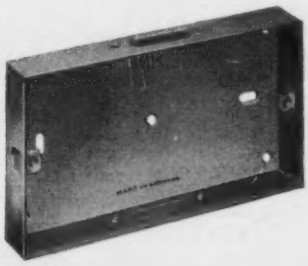
WRITE FOR LEAFLET 257

PLASTER-DEPTH BOXES FOR M.I.C.C. CABLE

These boxes have one clear entry and one knockout for attaching either single or double entry cable clamps.



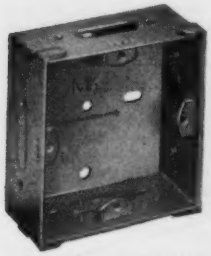
List No. 3951—Plaster-depth box with 2¾" fixing centres.



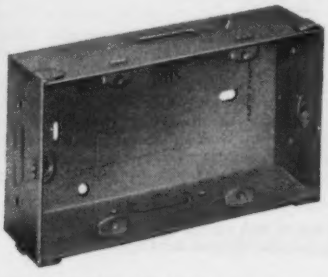
List No. 3952—Plaster-depth box with 4¾" fixing centres.

DEEP BOXES FOR M.I.C.C. CABLE

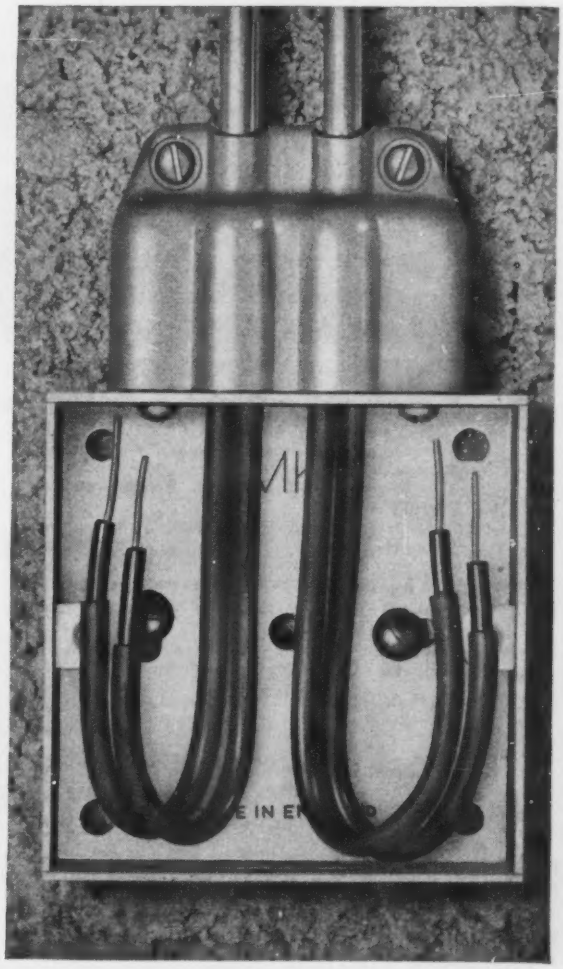
Deep boxes have one clear entry on one side and one knockout on each of the other three sides and one in the back to which can be attached a single or double entry cable clamp.



List No. 881—Box to BS 1299/1363 dimensions having 2¾" fixing centres.



List No. 882—Box to accommodate any two gang MK accessory.



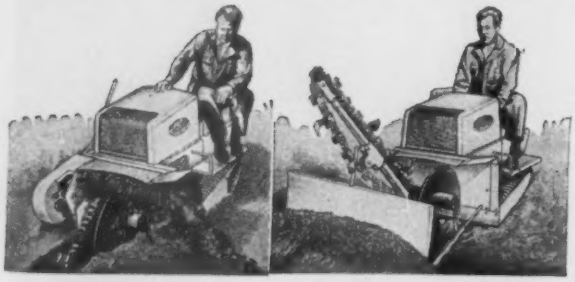
M.K. ELECTRIC LIMITED, SHRUBBERY ROAD, LONDON, N.9. EDMONTON 5151

MK197DHB

IT'S HERE

The trencher you've been waiting for

The ALLEN 3/12



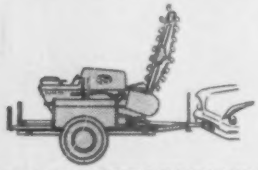
DIGGING **BACKFILLING**

This versatile small trencher and backfiller will dig trenches 3" to 4" wide, down to 5' 6" deep, or 12" wide to 2' 6" deep, with a range of intermediate width and depth capacities. The digging boom is controlled hydraulically, and can be telescoped to suit the depth of trench. It is powered by a 12½ h.p. 4-stroke engine.

The **ALLEN 3/12** is ideal for builders, plumbers, public works contractors, telephone, water, gas and electrical undertakings, etc., and offers speedy, low-cost, mechanical trenching and backfilling for an almost endless variety of jobs.

The **ALLEN 3/12** is approximately 6' 4" long, 3' 1"wide, 3' 1" high and weighs 1,350 lbs.

For transportation from site to site, a specially designed trailer is available. with tilting platform for easy loading.



Fill in and post the coupon below for full details of this superb machine.

ALLEN

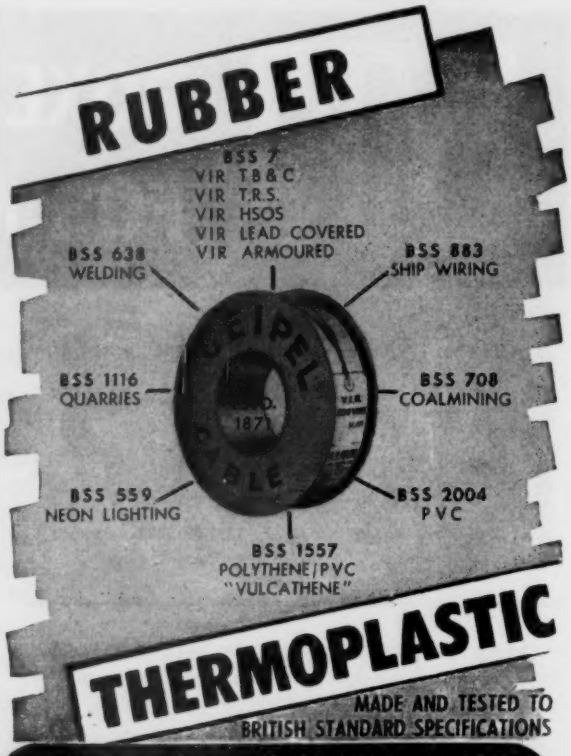
To: JOHN ALLEN & SONS (Oxford) LTD COWLEY, OXFORD, ENGLAND
Please send full details of the ALLEN 3/12 Trencher

Name .....

Address .....

9 ..... Tel. .....

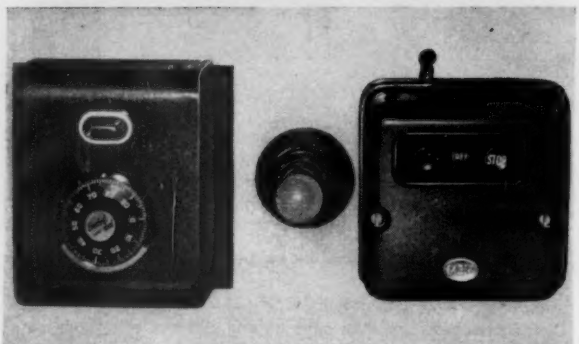
RUBBER



THERMOPLASTIC

MADE AND TESTED TO BRITISH STANDARD SPECIFICATIONS

WILLIAM GEIPEL LTD.
HEAD OFFICE 156-170 BERMONDSEY ST · LONDON · S.E.1
CABLE WORKS WEMBLEY



Manufacturers concerned with security control of machine tools will be interested in the above, which shows a standard 'on-off' starter controlled by an ELECTRO-DIAL. Easily fitted to any machine, the dial being housed in a metal container for screwing to framework. Wiring instructions are supplied.

The object is that the starter cannot be put to 'on' until the correct combination is dialed, thereby preventing unauthorised switching on, with danger to employees and probable damage of machine tools or components. Closed circuit is indicated by neon lamp above the dial. At completion of machinery operation scramble dial by one complete turn. Machine cannot be started until combination is re-dialed.

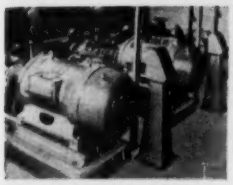
Suitable for use in 3 phase and 1 phase.

Cost of the complete unit ready for installation is £7 19s. 0d.— Demonstrations arranged.

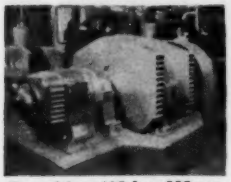
CODE DESIGNS LTD.

OLDFIELD LANE, GREENFORD, MIDDLESEX
Tel: WAXLOW 2828

One of twenty-two 20 h.p. 1460 rpm. flame-proof squirrel-cage motors (Type KFB) driving L. A. Mitchell reactor agitators.



Two of four 100 h.p. 2920 r.p.m. squirrel-cage motors (Type HRSP), with pedestal control stations, driving water pumps.



Two of four 425 h.p. 300 rpm. salient pole synchronous motors (Type SM) with overhung exciter driving L. Sterne's refrigeration compressor.

Over 650 AEI Motors

for one of the world's most modern synthetic rubber plants

The new plant of the International Synthetic Rubber Company at Hythe is capable of producing 70,000 tons of synthetic rubber a year using butadiene and styrene as the main raw materials. Three grades of rubber are produced suitable for making motor vehicle tyres, coloured rubber products and general products. The motors ranging from 0.25 to 620 h.p. and used for driving pumps and compressors, were all supplied by AEI. In addition, AEI made and erected the switchgear, transformers and other substation equipment for this plant.

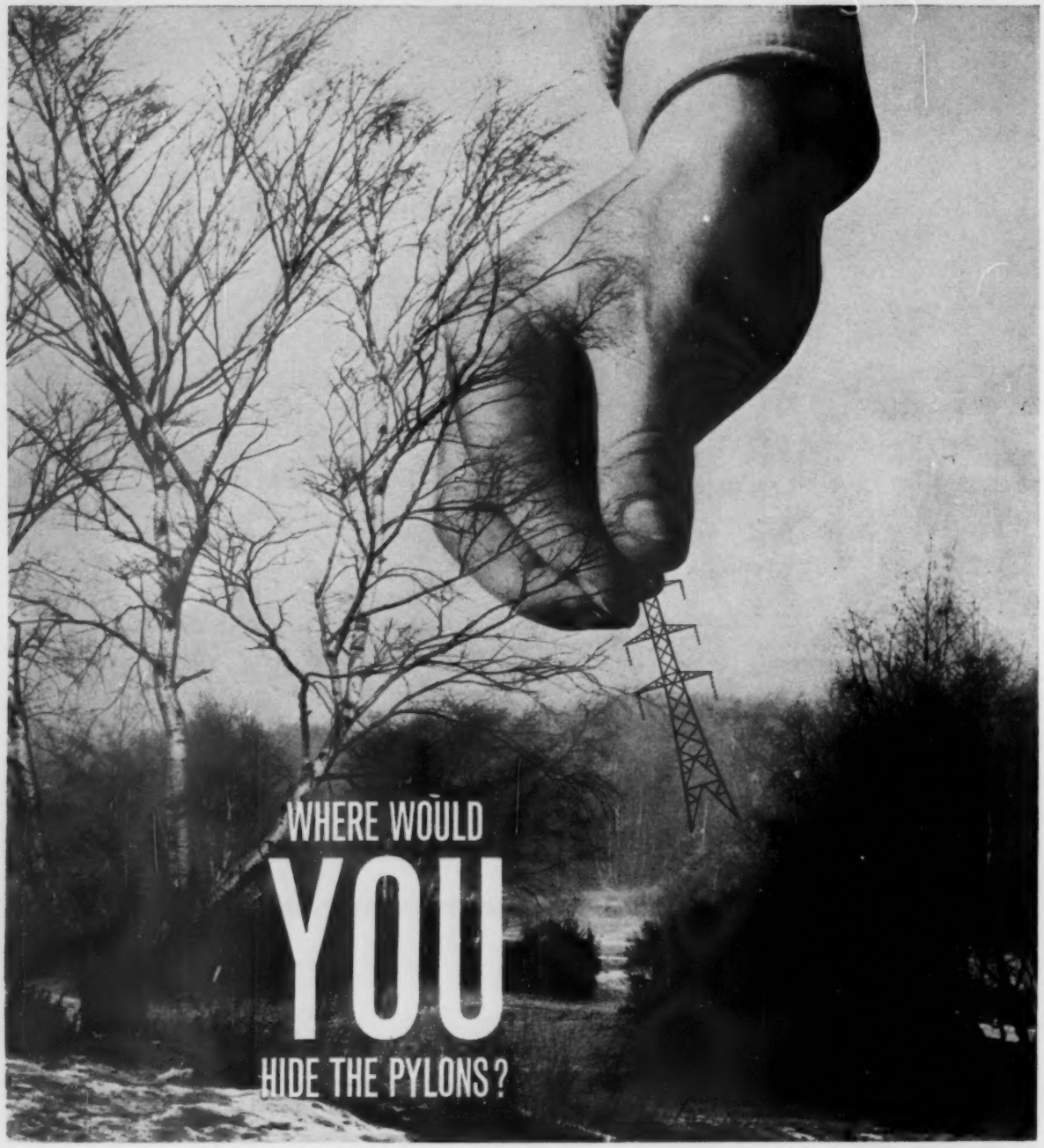
AEI

Associated Electrical Industries Limited

Motor and Control Gear Division

RUGBY & MANCHESTER

A5580



Not even trees can hide the pylons completely . . . but pylons there must be if people want the amenities that depend on electrical power. Over the next ten years Britain's power demands will double—and that means more overhead lines.

But although pylons can't be made invisible, power lines can be planned to follow the least conspicuous route, to take advantage of natural screens such as woods and hills, and only break cover when unavoidable. This kind of careful planning, which is going on all over the country today, is in the hands of the Central Electricity Generating Board, which is charged by Act of Parliament to provide an efficient and economical power supply to the nation, while doing everything possible to preserve the natural beauties of the countryside.

■ These advertisements are appearing in the farming and country magazines. The Central Electricity Generating Board thank electrical contractors for their co-operation in the past, and know that they will do all they can to preserve the amenities of the countryside.

THE CENTRAL ELECTRICITY GENERATING BOARD CEGB

NEWS SHEET

Bulk supply tariff increased from 1 April, 1961. 5s more on kW demand charge, 0·01d per kWh added to running charge. Comprehensive review of tariff to be carried out soon. (981, 1011)

Electrical central heating systems freed from purchase tax under new Customs and Excise Order. Electrode boilers, hot air systems and heat pumps with over 30,000 B.Th.U/hr output covered. (982, 1013)

Transformers failed on Scottish B.R. trains during trials, reveals evidence at public inquiry. Five incidents led to decision to withdraw trains. (992)

British Electric Cable Testing Organisation is registered title of new association with twelve cable manufacturers named as subscribers. (1011)

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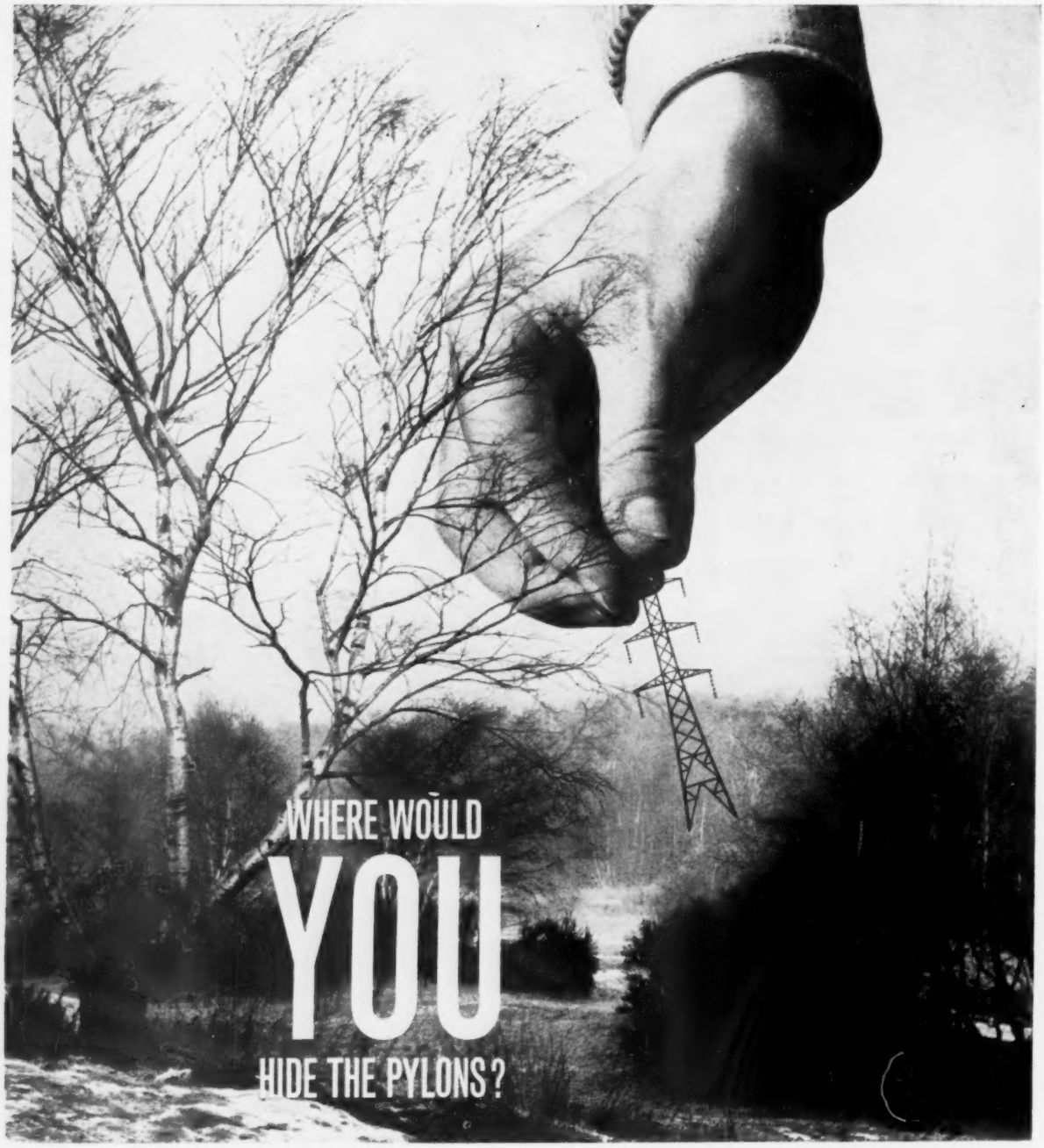

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NEWS SHEET

Fast excitation systems for large machines manufactured by AEI use rotating machine amplifiers or static magnetic amplifiers, giving varying speeds of response. (990)

Winding-up order against Merseyside Engineering (Refrigeration), "Everest" appliance firm, on petition of Hans Liebherr, German manufacturing firm. Other creditors for £36,000 support petition. (1013)

Midlands EB chief engineer says voltage cuts came from CEGB plant shortage; but CEGB say grid voltage and frequency were normal, spare plant capacity was available for the area. (1011)

£3,147 awarded for damages from operating theatre explosion caused by electrostatic spark. Dry atmosphere of theatre was responsibility of Hospital Board. (1013)

Pay increases in engineering industry, ranging from 8s 6d per week for skilled men to 7s for women. Applies from 26 December. (1012)

More discussion of electrode boiler results in correspondence columns, referring to CEGB comparative tests of various methods of heating power station office blocks. (990)

Plan for uniform lighting of Kingston By-pass held up by Surbiton B.C. who refuse to contribute, claiming it is Ministry of Transport's responsibility. (1012)

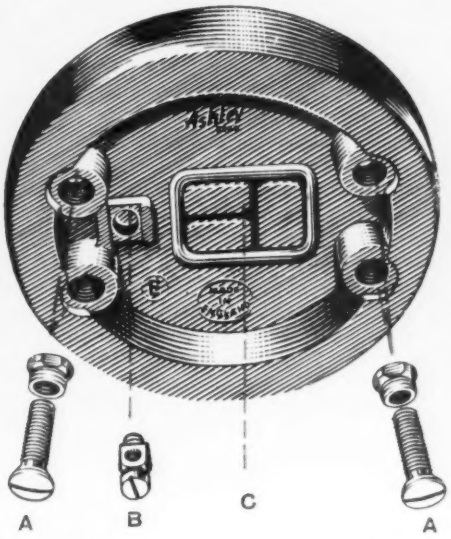
November electrical exports a record for 1960, at £27m.; over £2·8m. up on the previous highest month, January. Imports also a record at £5·6m. (1007)

Off-peak floor-warming installed in large Birmingham building, new TI headquarters has all-electric services. (1001)

BUSINESS—£1¼m. oil-filled cable contract for Pirelli-General . . . £50,000 net loss by H. J. Baldwin . . . Belliss and Morcom pass interim . . . Brazilian Traction L and P resume dividend with 25 cents interim . . . J. H. Fenner to make scrip issue. (1016)

OVERSEAS—South Wales Switchgear secure transformer contract for Jamaica . . . German 150 MW nuclear power reactor contract placed with N. American Aviation . . . Russian engineers say Egypt's Aswan dam output can be boosted to 2,400 MW . . . In Pakistan GEC to make motors up to 25 h.p. in co-operation with local company . . . Sydney expects £114,000 surplus next year. (997)

*news for you



INTRODUCING THE *Ashley* 'POLYBLOK' (PATENT PENDING) a new and improved mounting block

Designed on completely new principles allowing easy location on ceilings, walls, independent of and before the accessory or light fitting is surmounted.

SPECIAL FEATURES

A. 2 B.A. x ¼" Plated fixing screws and tapped inserts—supplied loose.
B. Optional large capacity earth terminal for loop-in wiring.
C. Composite 3 way base Knockout—each section will take 3/.029 three core T.R.S., L.A.S., or P.V.C., cable.

Six Knockouts in sides for surface entry of 3/.029 cable. Either vertical or horizontal wiring entry for Ashley Batten Lampholder by selecting the appropriate 'Polyblok' fixing holes.

METHODS OF USE

1. Select fixing holes in 'Polyblok', present inserts to tapered recess and pull fully home by tightening 2 B.A. screw; remove screw and apply 'Polyblok' to working surface with wood screws in holes without inserts. The accessory can then be simply fitted by using 2 B.A. screws. The fitting or accessory can be removed and re-located, or taken down for inspection without risk of damage to plaster surfaces or losing screw grip.
2. Use two wood screws to fix 'Polyblok' in position, then after wiring ends are made off, use two further wood screws through the accessory and the unused pair of holes in the 'Polyblok'. This allows independent location of the accessory, using wood screws.
3. Use one pair of wood screws through both 'Polyblok' and accessory in the conventional manner.

Cat. No.	DIMENSIONS			KNOCKOUTS		For Accessories of Dia.	Colour	Quan. per Carton	Per Dozen List
	Dia.	Projection	Fixing Centres	Base	Sides				
MB 439	2½"	¼"	Two 2"	Composite	6	2¼"	Brown	2 doz.	7/4
MB 440	"	"	"	3 way	"	"	Cream	"	8/-
With Earth Terminal									
MB 439 E	2½"	¼"	Two 2"	Composite	6	2¼"	Brown	2 doz.	9/8
MB 440 E	"	"	"	3 way	"	"	Cream	"	10/4
MB FS1	2 BA x ¼" plated fixing screw and insert							2 doz. sets	2/- doz. sets

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NEWS SHEET

Fast excitation systems for large machines manufactured by AEI use rotating machine amplifiers or static magnetic amplifiers, giving varying speeds of response. (990)

Winding-up order against Merseyside Engineering (Refrigeration), "Everest" appliance firm, on petition of Hans Liebherr, German manufacturing firm. Other creditors for £36,000 support petition. (1013)

Midlands EB chief engineer says voltage cuts came from CEGB plant shortage; but CEGB say grid voltage and frequency were normal, spare plant capacity was available for the area. (1011)

£3,147 awarded for damages from operating theatre explosion caused by electrostatic spark. Dry atmosphere of theatre was responsibility of Hospital Board. (1013)

Pay increases in engineering industry, ranging from 8s 6d per week for skilled men to 7s for women. Applies from 26 December. (1012)

More discussion of electrode boiler results in correspondence columns, referring to CEGB comparative tests of various methods of heating power station office blocks. (990)

Plan for uniform lighting of Kingston By-pass held up by Surbiton B.C. who refuse to contribute, claiming it is Ministry of Transport's responsibility. (1012)

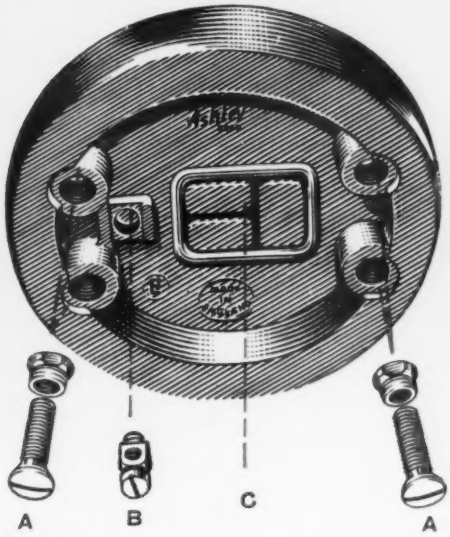
November electrical exports a record for 1960, at £27m.; over £2·8m. up on the previous highest month, January. Imports also a record at £5·6m. (1007)

Off-peak floor-warming installed in large Birmingham building, new TI headquarters has all-electric services. (1001)

BUSINESS—£1¼m. oil-filled cable contract for Pirelli-General . . . £50,000 net loss by H. J. Baldwin . . . Belliss and Morcom pass interim . . . Brazilian Traction L and P resume dividend with 25 cents interim . . . J. H. Fenner to make scrip issue. (1016)

OVERSEAS—South Wales Switchgear secure transformer contract for Jamaica . . . German 150 MW nuclear power reactor contract placed with N. American Aviation . . . Russian engineers say Egypt's Aswan dam output can be boosted to 2,400 MW . . . In Pakistan GEC to make motors up to 25 h.p. in co-operation with local company . . . Sydney expects £114,000 surplus next year. (997)

*news for you



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2. Use two wood screws to fix 'Polyblok' in position, then after wiring ends are made off, use two further wood screws through the accessory and the unused pair of holes in the 'Polyblok'. This allows independent location of the accessory, using wood screws.
3. Use one pair of wood screws through both 'Polyblok' and accessory in the conventional manner.

Cat. No.	DIMENSIONS			KNOCKOUTS		For Accessories of Dia.	Colour	Quan. per Carton	Per Dozen List
	Dia.	Projection	Fixing Centres	Base	Sides				
MB 439	2¼"	¼"	Two 2"	Composite	6	2¼"	Brown	2 doz.	7/4
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MB FS1	2 BA x ¼" plated fixing screw and insert							2 doz. sets	2/- doz. sets

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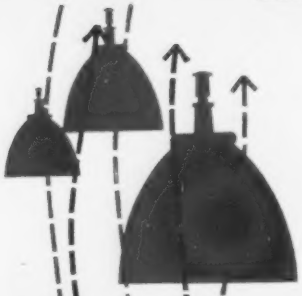

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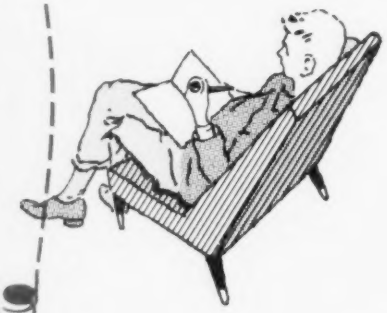

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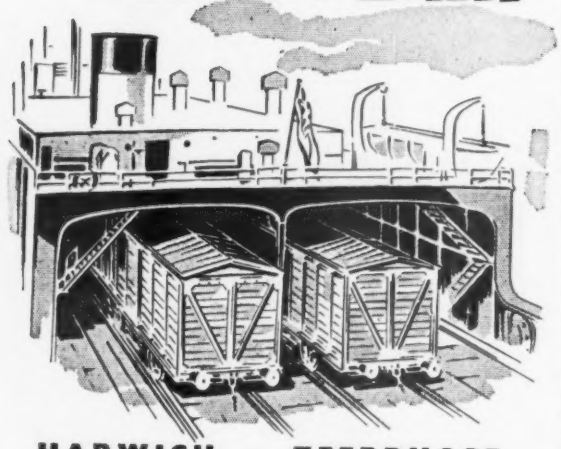

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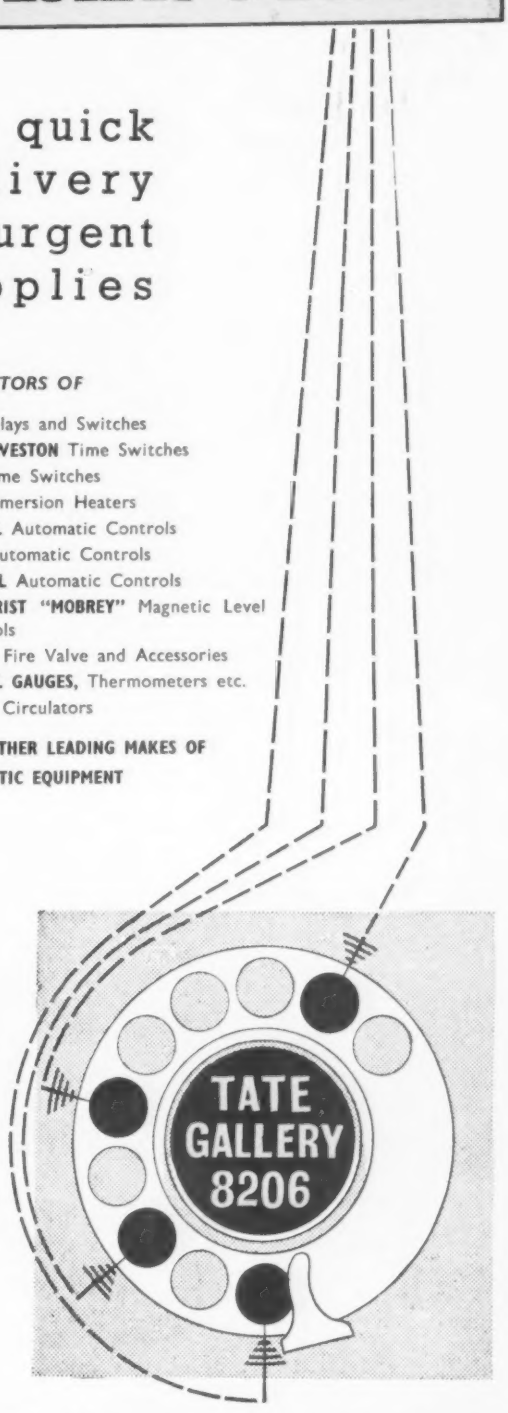

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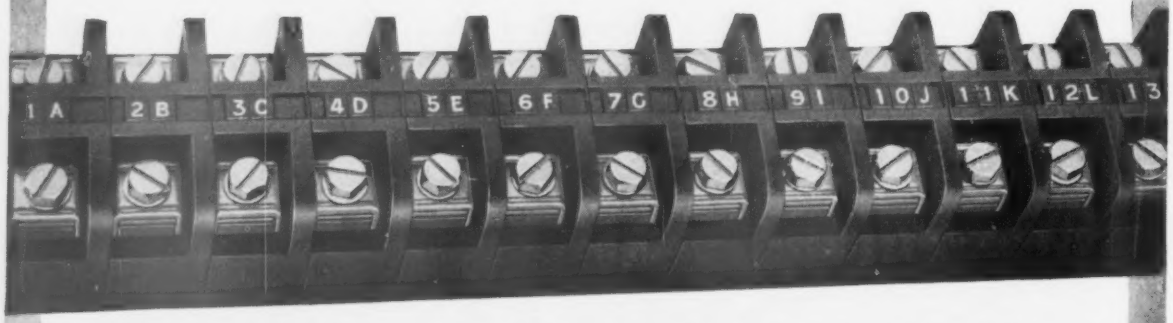

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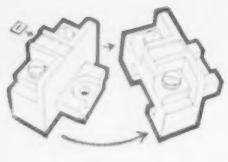

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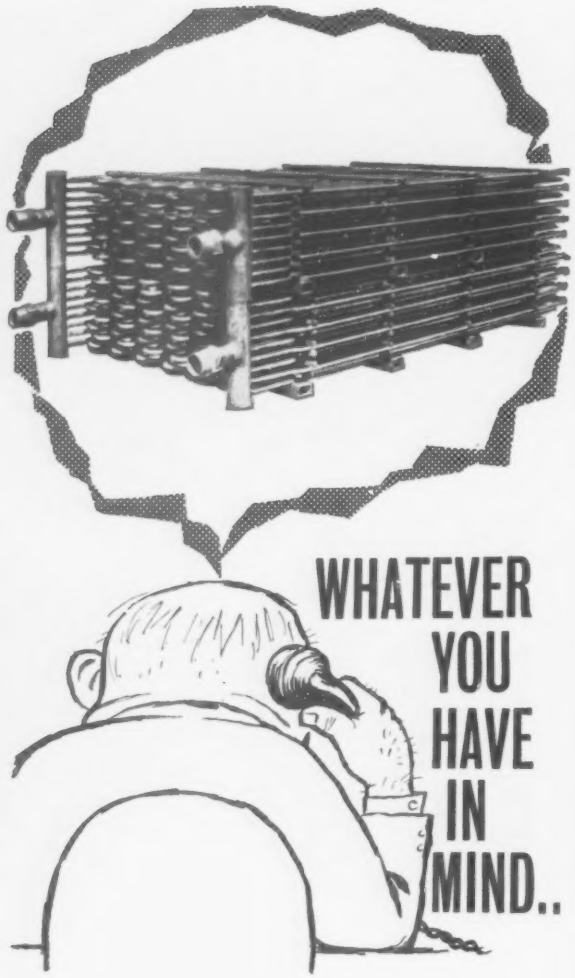

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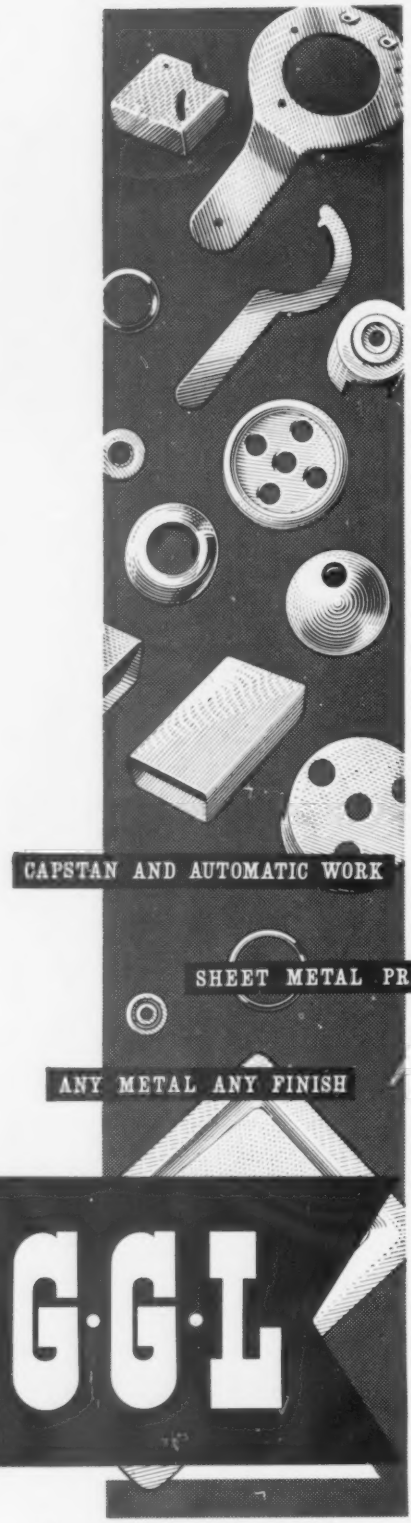

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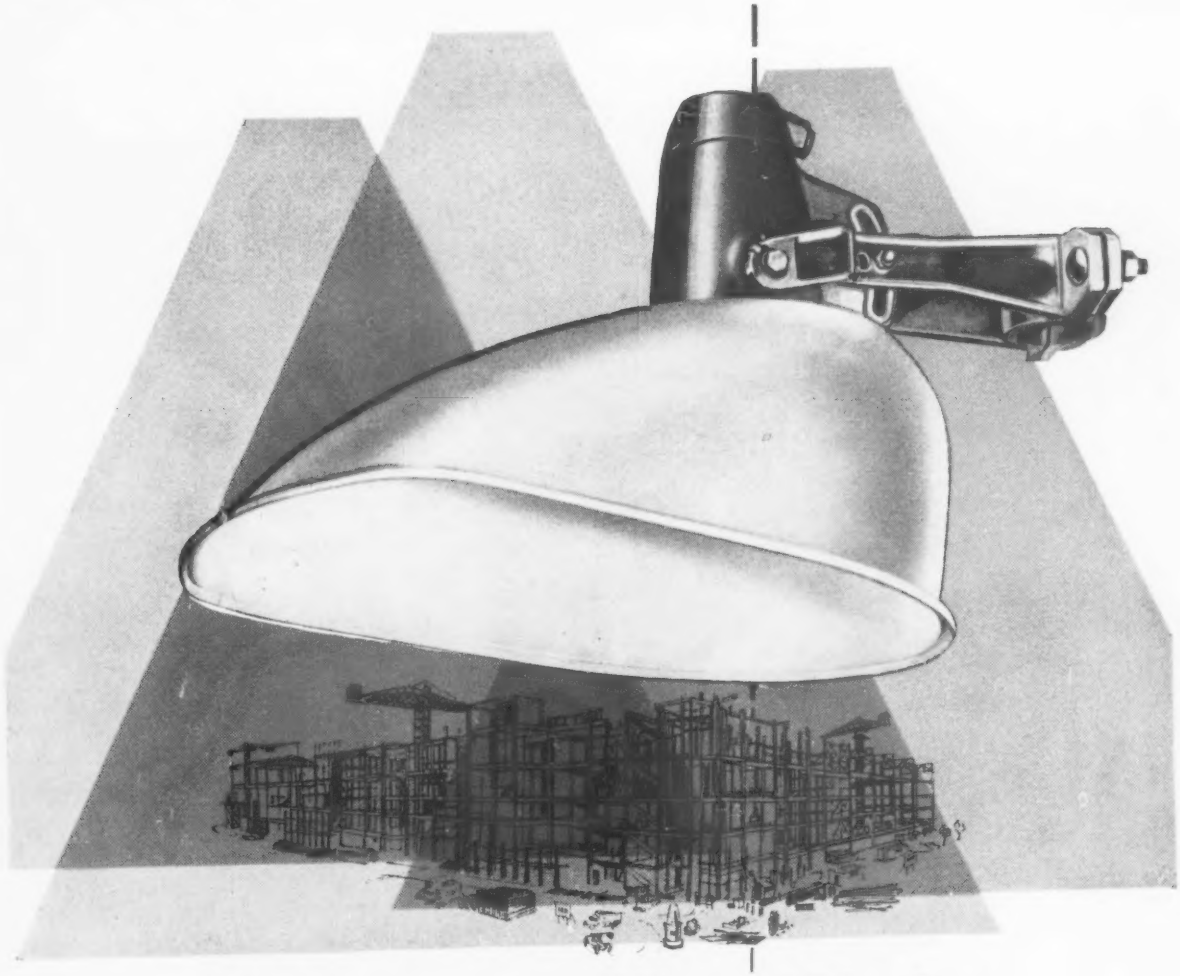

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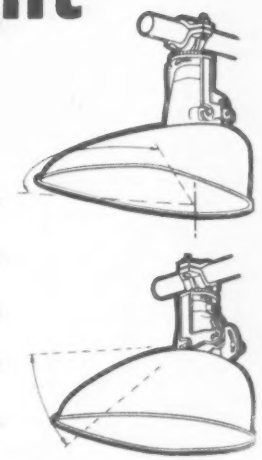

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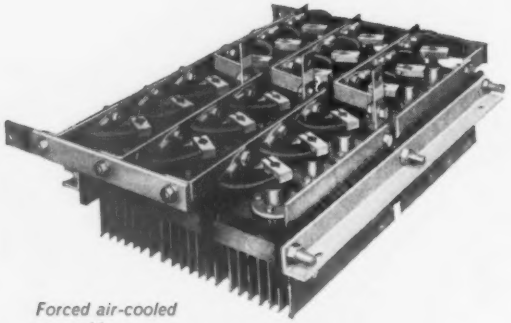

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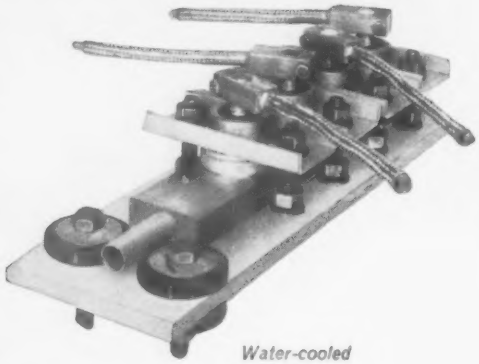

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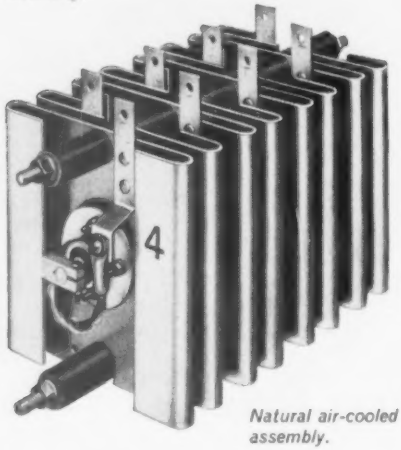

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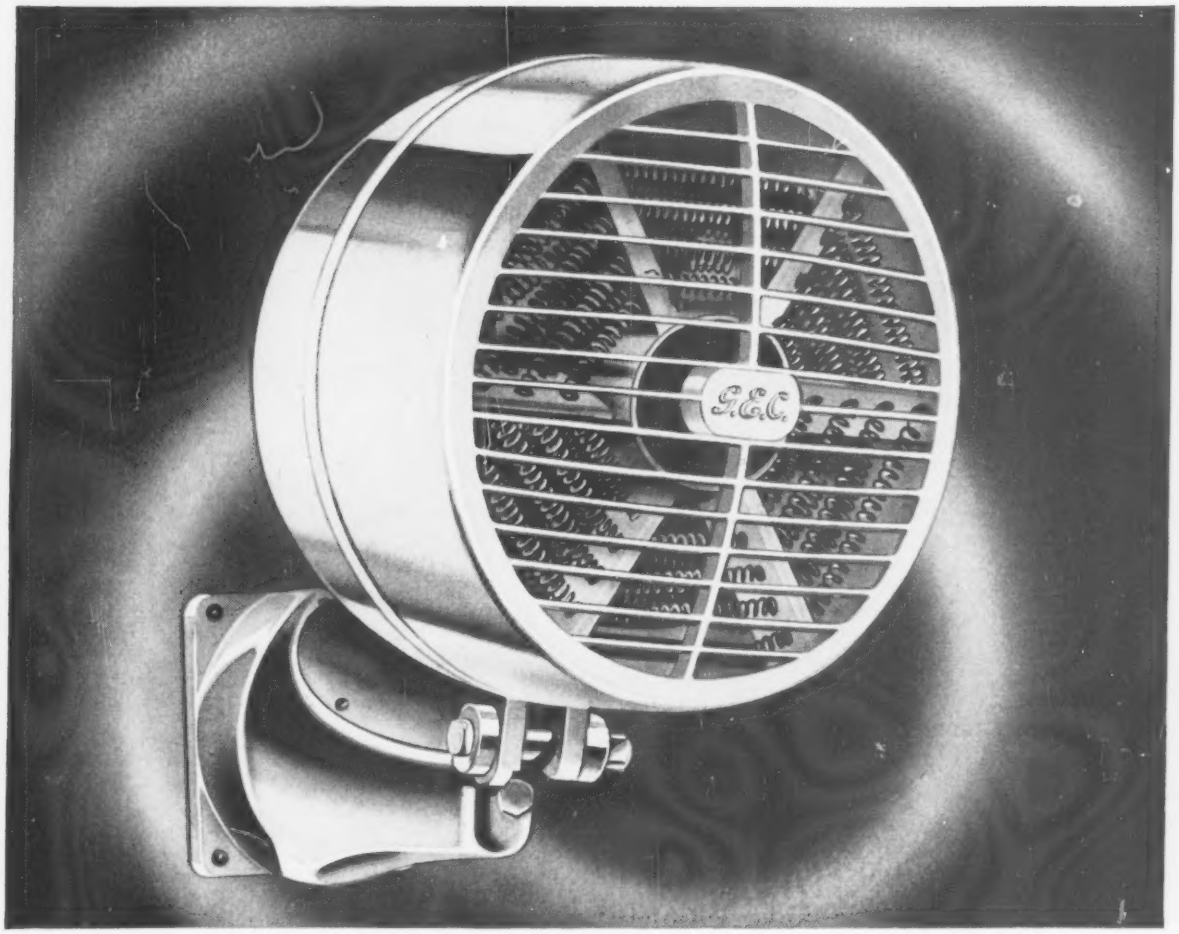

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Highlights of 1960 ... ... **994**

Transformers in Court **1000**

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Lighting Fittings Design **1003**
by J. Mellanby, M.A., A.M.I.E.E., M.I.E.S.

Dans ce numéro

Systèmes à Excitation Rapide, No. 3 ... ... **983**

Les systèmes d'excitation pour grosses génératrices fabriquées par A.E.I. Ltd. assurent une réponse rapide aux changements de charge, grâce à des amplificateurs magnétiques et, dans certains cas, à des amplificateurs tournants "amplidyne". L'utilisation des seuls amplificateurs magnétiques nécessite un équipement plus considérable, mais certains ingénieurs les préfèrent car il permettent d'avoir une installation complètement statique. Des circuits auxiliaires limitent la puissance fournie pour une excitation donnée; une excitation de secours est fournie par un appareillage fonctionnant à partir d'un alternateur pilote du type à aimant permanent, et par l'intermédiaire de redresseurs et d'amplificateurs magnétiques.

Revue de Fin d'Année **994**

Cette revue rassemble et illustre les évènements importants de l'actualité électrique en Grande-Bretagne et dans le monde pour 1960.

Accessoires de Fixation pour l'Eclairage **1003**

Les réalisateurs d'accessoires de fixation pour lampes à filament de tungstène, négligent souvent des détails qui compliquent la fixation, particulièrement dans le cas d'installations à câblage en canalisation. De plus, la mise au point de lampes à petite ampoule dont les culots s'échauffent plus qu'auparavant, introduit des problèmes thermiques touchant les supports de lampe et l'isolement des conducteurs. L'étude de ces différents points et une collaboration étroite, dès le départ, avec les ingénieurs chargés de l'installation, permettront de produire des accessoires de fixation d'une utilisation plus pratique, à la fois plus faciles et moins onéreux à mettre en place et à entretenir.

In dieser Nummer

Schnellwirkende Erregereinrichtungen, III **983**

Von AEI LTD hergestellte Erregereinrichtungen für Grossgeneratoren sprechen schnell auf Belastungsschwankungen an u. zw. kraft der Verwendung von magnetischen Verstärkern bzw. in manchen Fällen von "Amplidyne"-Drehverstärkern. Bei ausschliesslicher Verwendung magnetischer Verstärker, vergrössert sich die Einrichtung; diese Bauart wird jedoch von manchen Konstrukteuren bevorzugt, da sie eine durchwegs statische Einrichtung ergibt. Hilfskreise beschränken die Leistung, die bei gegebenem Erregungsgrad abgegeben werden kann, während eine von einem Wechselstromgenerator mit Dauermagnet durch Gleichrichter und magnetischer Verstärker gespeiste Einrichtung für eine Reserve-Erregung sorgt.

Das Jahr 1960 im Rückblick **994**

In einem Rückblick auf das Jahr 1960 werden wichtige Ereignisse auf dem Gebiete der Elektroindustrie in Grossbritannien und anderen Teilen der Welt kurz besprochen und mit Abbildungen illustriert.

Konstruktionserwägungen bei Beleuchtungskörpern ... **1003**

Glühlampenbestückte Beleuchtungskörper weisen oft Konstruktionsmerkmale auf, die Montage erschweren, besonders im Zusammenhang mit Rohrdrahtanlagen. Ausserdem bedingt die Entwicklung von Lampen mit kleinem Kolben und heisser werdender Fassung das Entstehen gewisser Probleme der Wärmezerstreuung. Würden sich Konstrukteure eingehender mit diesen Problemen befassen und vom Anfang an die Mitwirkung der Installateurkreisen sichern, kämen Beleuchtungskörper zustande, die in der Anwendung praktischer und in Einbau und in der Instandhaltung leichter und billiger wären.

FEATURES

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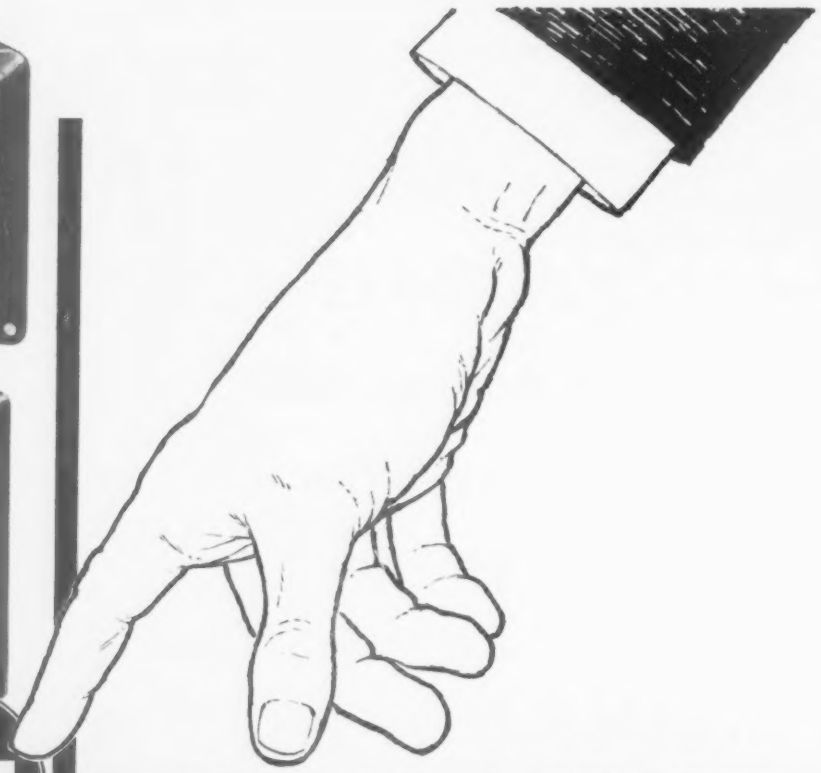
Watertight pattern surface mounting 2 CSU/W "Start"—"Stop"

Watertight pattern surface mounting 3 CSU/W "Forward"—"Reverse"—"Stop"



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MIDLAND ELECTRIC MANUFACTURING CO. LTD., REDDINGS LANE, TYSELEY, BIRMINGHAM 11

ELECTRICAL
TIMES

ESTABLISHED 1891

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Comment

UNCERTAIN YEAR

Each new year brings its good omens and its bad, and the area of uncertainty that lies between such prognostications is perhaps larger than usual this year. Against the general background of too slow a rise in the country's productivity and exports, the new year brings the first move of the European Common Market towards a common external tariff. This will result in tariffs being raised in those countries which are our best electrical customers, while within the Six a further 10% will be taken off internal tariffs. The bite of the ECM will begin to be really felt. At home, the 50-odd electrical trading agreements will come on to the dissecting table of the Restrictive Practices Court and, whatever the outcome, the process will be painful, with the prospect of the results being considerably more so. The domestic appliance field continues as chaotic as the Congo, with new firms coming into the market and some old ones going out. Any feeling of stability seems a long way off. Nor can too much be hoped from any hire-purchase remission. In the particular appliances in which it is a significant selling factor, it was recently shown that 10% more sales is the most that can be hoped for. As for the chances of such remission, these must be divined in the context of the motor-car industry. On the heavy plant side, there seems little hope of filling up the many pockets of spare production capacity, but there is some hope of slight improvement. On the lighter side, business promises to be good in many sections. For the supply industry, the year will be marked by the large-scale introduction of nuclear power into the CEGB economy, but before then there will be some fingers crossed for the ability of plant available to meet the winter load. A bulk tariff increase in April and a round of rises in retail tariffs lie ahead, but even these are unlikely to suppress the rise in electricity demand which is the permanent bright spot of every 1 January.

BULK SUPPLY ADJUSTMENT

Increases of 5s/kW of maximum demand and 0·01d/kWh in the bulk supply tariff should in 1961-62 net the CEGB about £11 million more than they would have received under existing terms. The alterations represent both an increase in income to meet recent wage awards and high interest rates, and a further instalment in the plan to obtain a higher proportion of Board income from fixed charges, which, through the notional aggregate demand written into the tariff, is practically guaranteed income, without respect to recorded demand. The new tariff is notable for including for the first time for some years an increase in the running charge component, quite apart from that which will come from operation of the coal

ELECTRICAL GROUPS

Next week's issue will contain a revised and enlarged edition of the ELECTRICAL TIMES publication listing some 150 holding companies and their electrical subsidiaries, arranged to form a useful work of reference.

cost adjustment clause as a result of the autumn rise in the price of power station coal. Since efficiency of generation continues to rise, a fall in the basic unit charge would seem a proper corollary of higher fixed charges to meet the cost of equipment for higher efficiency. Presumably, it was felt that some unbalance had crept in which justified this step. To have kept the running charge unchanged and obtained the same increase in income would have involved increasing the kW charge by more than 8s, instead of 5s. In any case, the official CEGB statement makes it clear that the present adjustments are being regarded as interim changes; a complete review of the structure of the tariff is promised. This is likely to be timely, for the introduction of nuclear generation as an increasingly important source of supply from next year onwards will undermine some of the fundamental principles of charging for bulk supply as between one area board and another. As it stands at present, the bulk supply tariff recognises nuclear generation only in terms of explicitly ruling it out of consideration in fuel cost adjustment calculations.

ONE ANOMALY FEWER

Purchase-tax practice is so packed with anomalies that any attempt to clear them up takes on a Canute-like ineffectiveness. However, some parts of the electrical industry will be glad that one of the more glaring inequalities of treatment of electricity as against other fuels should have been removed. A decision taken last week to add to the list of exemptions, electrode boiler, immersion heater and heat pump central heating systems of over 9 kW capacity came as an acceptable Christmas present, especially to promoters of heat pumps. For supply engineers, it might not look so pleasant, although loads of this magnitude are becoming increasingly accepted on residential mains systems. But how the PT changes extend the anomalies! A heat pump for general house heating is exempt from purchase-tax; yet the combination of heat pump and refrigerator apparently remains liable, due to the working of the precise definitions in the purchase-tax regulations. Moreover, under the new rules, special arrangements are made for exempting systems that circulate hot air to one or two rooms. If wires instead of ducts are installed and the energy is circulated in the form of electricity, then, of course, full tax has to be paid. This would apply even if the national interest were being served by peak-avoiding block storage heaters being installed.

ELECTRICAL FIRMS FOR SHIP PROPULSION

Relatively slowly, the effort the electrical manufacturing industry puts into research and development is being recognised. The industry has for long been ahead of most other parts of the British manufacturing sector in this respect, but has rarely received public recognition for this, or public appreciation of the importance of trade associations in making it possible. The recent release of the long-heralded DSIR report criticising the shipbuilding industry provides another example of the way examination of other industries is showing the efforts of the electrical industry to be praiseworthy. The conclusion of the DSIR report is, briefly, that competitiveness in international markets suffers if there is not an effort of reasonable magnitude in the research and development field. Such an effort demands professional manpower and investment in facilities. This the electricity industry has always supplied.

RAIL REORGANISATION

The White Paper on reorganisation of the British Transport Commission that was published just before Christmas is not, of course, the news for which the electrical industry is waiting. That will only come when the Government announces its decision on the course of modernisation on the railways, whether main-line electrification is to continue. The White Paper makes it clear that the drive for modernisation in some form is to go on, perhaps become intensified as the railway regional boards drive for financial self-sufficiency in about five years' time. At such a juncture, it is worth recalling that the House of Commons Select Committee on Nationalised Industries, whose report has been one of the major factors in the present reconstruction of the BTC, was highly critical of the smallness of the professional engineering staff employed by the railways. When the new organisation is evolved, there will need to be far more provision for engineers, and they will have to be accorded higher status within the boards if the best is to be realised from scientific and technological advances in terms of railway transport in this country. Changes will, of course, have to take place slowly; the present BTC structure cannot be altered overnight, nor can suitable recruits for railway electrical engineering be found easily. But it is in the formative months of the new boards, assuming that Parliament accepts the Government's proposals, that a path can be cleared for this important change in staffing. In the many pressing claims for consideration, this fundamental point must not be overlooked, and it is at least reassuring that the Minister of Transport has acknowledged, in a Parliamentary answer, its existence and significance.

Meteor

This week's quick summary of electrical news faces advertisement page 8

Fast excitation systems

LARGE GENERATOR SCHEMES—No. 3, A.E.I.

by D. R. Fenwick,* A.M.I.E.E.

AUTOMATIC voltage regulators, employing either magnetic amplifiers alone or magnetic amplifiers in conjunction with rotating amplifiers, have gained increasing prominence in the field of power generation: in the past decade they have been applied extensively to steam turbo-generators both at home and abroad. This trend may be partly due to the neatness of the equipment and to the reduced demands on maintenance personnel, but this is by no means the full story.

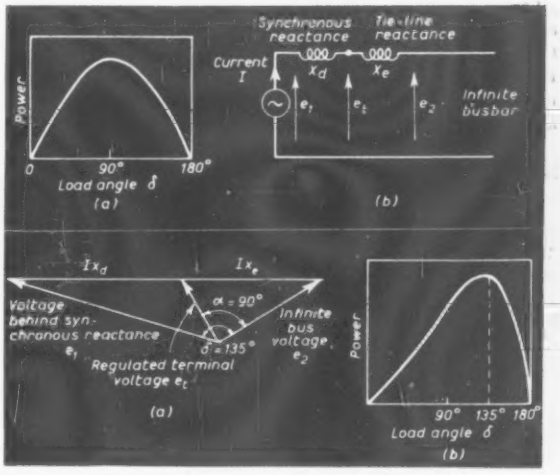
Stable operation beyond the manual control limit in the so-called dynamic stability region, i.e., at load angles in excess of 90°, is dependent on the inclusion of a continuously acting regulator of suitable dynamic design in the excitation control system. The new regulators fall into this category, and by far their greatest advantage over the earlier types lies in the enhanced under-excited capability of the regulator/machine combination.

Dynamic Stability

Before discussing specific equipments, a few words in explanation of the phenomena of dynamic stability operation will not be out of place. Operation in the dynamic stability region implies operation at load angles in excess of 90° and in this connection it will be useful to examine the power angle diagram, Fig. 1(a), and schematic representation, Fig. 1(b), for a synchronous generator with fixed excitation and coupled to an infinite busbar by a reactive tie line. In this case the maximum power transfer occurs when the angle between the excitation voltage and that of the infinite busbar is 90°.

When the load angle is less than 90° any disturbance tending to increase this angle results in an increase of transmitted power from the generating unit to the infinite busbar. If the power input to the generator is considered to be fixed, the unit decelerates, thus reducing the load angle to its initial value; the system is, therefore, stable. At a load angle of 90° the smallest disturbance tending to increase the angle results in a transmitted power smaller than the generator input, and accordingly in this case the generator accelerates to increase the load angle still further; the system is clearly unstable. At load angles greater than 90° the same state of affairs exists, whilst at angles just below 90° the system is stable. Operation with a load angle of 90° under the prescribed conditions is the maximum possible, no safety margins to cater for disturbance of any kind being in hand.

Fig. 2(a) is a typical vector diagram for a machine coupled through a reactance to an infinite busbar, and it will be appreciated that without a voltage regulator an increase of load angle (δ) would be accompanied by a corresponding reduction of terminal voltage, e_t. Were a perfect voltage regulator applied to the terminals of the machine, the terminal voltage would not fall as the load



Figs. 1 and 2. Dynamic stability fundamentals

Fig. 1 (top). (a) Power-angle curve of a synchronous generator with fixed excitation, coupled to an infinite busbar by a reactive tie-line. (b) Schematic representation of a synchronous generator coupled to an infinite busbar by a reactive tie-line

Fig. 2 (bottom). (a) Vector diagram of synchronous generator coupled to an infinite busbar by a reactive tie-line when controlled by a perfect a.v.r. (b) Power-angle curve of a synchronous generator coupled to an infinite busbar by a reactive tie-line and controlled by a perfect a.v.r.

angle increased, and accordingly the voltage behind the synchronous reactance e_1 would correspondingly increase. The vector diagram shows the situation when the angle α between the infinite busbar e_2 and the controlled terminal voltage e_t is 90°, at which angle the power transfer is at a maximum. Fig. 2(b) shows the corresponding power-angle curve with the maximum power transfer occurring at a load angle well in excess of 90°.

Practical systems fall short of the ideal, as would be expected. Excitation power and generator field time constant impose obvious limitations. Successful operation in the dynamic zone involves the solution of what is essentially a servo-mechanism problem, in which the electromechanical characteristics of the machine as well as the characteristics of the voltage regulator and power system itself are significant.

In describing the various types of VTSR automatic voltage regulator that have been successfully employed for the excitation control of steam turbo-generators, the results of dynamic performance studies are given.

Direct comparisons of dynamic stability capability are based, in this article, on an examination of the oscillation of load angle subsequent to a small disturbance. In all cases the steady-state loading corresponds to the rated power of 0·8 p.u. with 1·2 p.u. under-excited reactive, and the load angle under these conditions is 135°. It will be understood that in those cases in which the damping of load angle subsequent to a small disturbance is fairly rapid, an extension of dynamic stability limit beyond that shown in Fig. 3 would be obtainable. In all cases the rated

* Mr Fenwick is with Associated Electrical Industries Ltd. The article is based on a lecture in a series on fast excitation systems for modern turbo-alternators, held at the Borough Polytechnic (Organising lecturer: Mr L. F. Spence).

terminal voltage of 1·0 p.u. has been used, whilst a value of 50 p.u. for the electro-magnetic and mechanical damping of rotor swinging has been assumed. The transient reaction of alternator terminal voltage on open circuit on introducing an error signal into the reference circuit of the automatic voltage regulator is given.

In all cases the settings of the various stabilising feedback circuits remain the same for both the open circuit and dynamic stability tests.

Before proceeding with the description of the equipments in service it is interesting to consider the performance of the ideal automatic voltage regulating system given in Fig. 4. In this case the automatic voltage regulator and exciter are both assumed to have zero time constant, the combined gain of regulator and exciter being 40. Fig. 4(a) gives the transient response of terminal voltage on open circuit, whilst Fig. 4(b) shows the degree of load-angle damping in the dynamic zone as previously described.

Smaller Machines

In common with most of the Type VTSR regulators that have been used for the excitation control of steam turbo-generators, the reference unit in equipment for use with smaller machines takes the form of a bridge of semi-conductors. The Type VTSR/167 regulator differs from the Type VTSR/164 only in that the reference used takes the form of a bridge employing two Zener diodes and two linear resistances. The semi-conductor bridge still most commonly employed comprises four arms, each of which includes a semi-conductor which obeys the law $V=KI^{\beta}$; this arrangement is illustrated in Fig. 5. In practice, the material used for two arms of the bridge has a value of β approximating to 0·2, whilst that of the other two arms is approximately 0·6.

With this arrangement, a signal output characteristic as shown in Fig. 6 is obtainable, and it is common practice to employ clipping rectifiers as shown to limit the maximum signal from the bridge. In certain cases the omission of clipping rectifiers could result in malfunctioning of the magnetic amplifier equipment due to overdriving. A bridge as described does not suffer from frequency sensitivity. Owing to the high negative temperature coefficient of the material used, thermal drifting could easily be experienced if normal linear resistance material

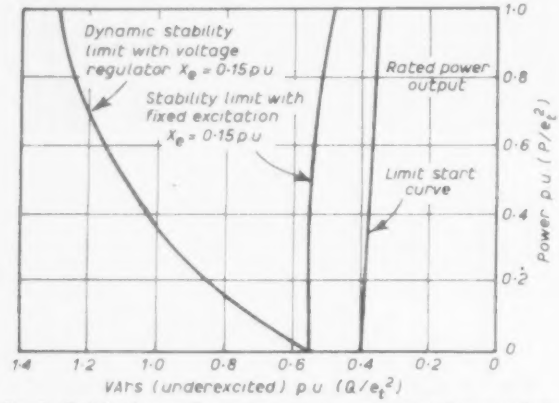


Fig. 3. Stability limits of a synchronous generator coupled to an infinite busbar by a reactive tie-line

Generator details: Cos ϕ = 0·8, X'_d = 0·2 p.u. X_d = 1·8 p.u., T'_{do} = 1·8 p.u.
Base power = 1·0 p.u. H = 3·1 kW/kVA, e_t = 1·0 p.u. (nominal).

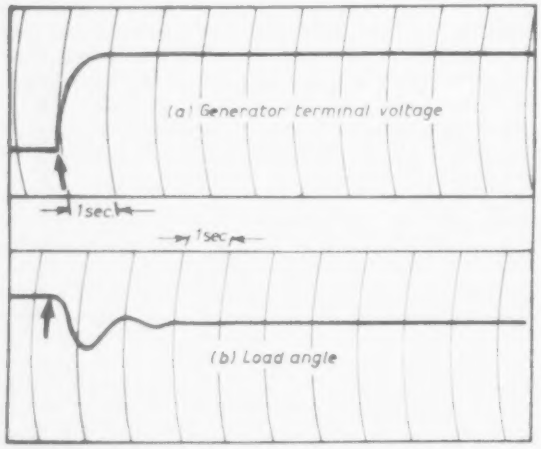


Fig. 4. Response to step change of ideal automatic voltage regulator system. Regulator and main exciter time constants are equal to zero, and the combined gain is equal to 40

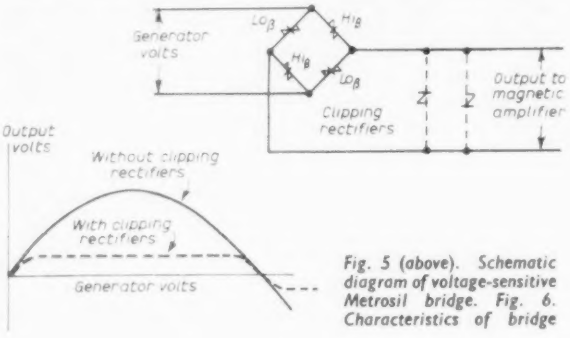


Fig. 5 (above). Schematic diagram of voltage-sensitive Metrosil bridge. Fig. 6. Characteristics of bridge

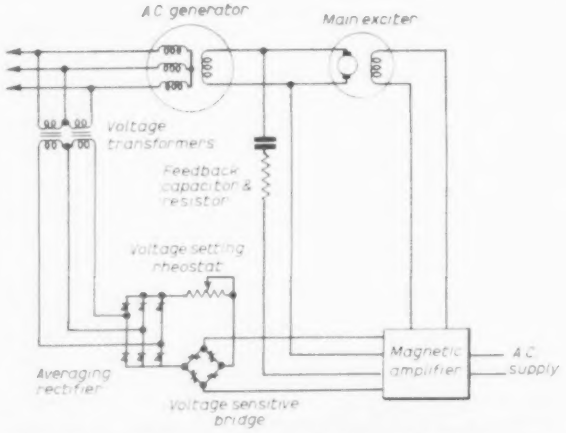


Fig. 7. Schematic diagram of Type VTSR/164 or VTSR/167 automatic voltage regulator applied to a synchronous generator

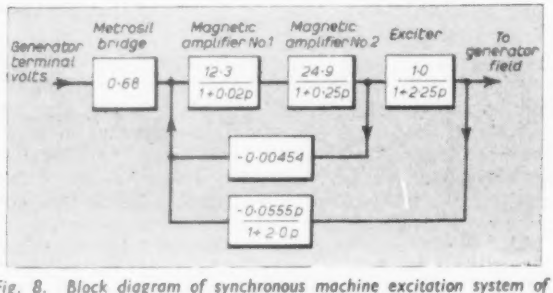


Fig. 8. Block diagram of synchronous machine excitation system of type shown in Fig. 7

were used for two of the arms instead of the high β semi-conductor material described. With the arrangement used, all arms of the bridge have similar temperature coefficients and the difficulty is avoided.

The basic circuit of the regulator is shown in Fig. 7. It will be seen that the three phase voltages of the machine are averaged by a three-phase full-wave rectifier and thence applied through a voltage setting rheostat to the bridge of Metrosil semi-conductors. The output of the bridge, which varies from positive to negative, depending on whether the voltage of the alternator is below or above normal, is fed to the magnetic amplifier, which obtains its supply from the station auxiliary main. The output of the magnetic amplifier is employed to separately excite the main exciter.

Stabilisation is achieved principally by the application of derivative feedback from the main exciter armature, a capacitor-resistor network being used for this purpose as shown.

The power supply for the magnetic amplifier is derived from the a.c. auxiliary main and, therefore, some arrangement must be made to ensure that excitation is sustained during faults which may occur on the main or auxiliary supply system. To this end a contactor is arranged to change the main exciter from separate to self-excitation at a predetermined level in the event of loss of power supply.

The block diagram of the excitation system is shown in Fig. 8, whilst the open-circuit transient response and load angle damping characteristic in the dynamic zone are shown in Figs. 9(a) and 9(b), respectively. It will be noticed that whereas the open-circuit transient response is quite good, the damping of the load angle is not of the same standard. At lower under-excited powers, of course, the situation would be improved.

Amplidyne Equipment for Medium Size and Large Machines

The arrangement of the type of equipment, in which a magnetic amplifier of the flux resetting type feeds the buck field of an amplidyne, is shown in Fig. 10. The boost field of the amplidyne is fed from a pilot exciter and provides excitation corresponding to half the ampere-turns of which the buck field is capable. Accordingly, when the magnetic amplifier is delivering normal current corresponding to normal generator voltage to the amplidyne, the buck and boost field ampere-turns cancel each other out. The armature of the amplidyne is included in the shunt field circuit of the main exciter, the resistance of which is so arranged that at full load the main exciter is completely self-exciting. With this arrangement, under steady-state conditions the output of the amplidyne is zero, whilst the full positive or negative output remains available for control purposes. The magnetic amplifier has a relatively small output by virtue of the favourable amplifying characteristic of the amplidyne, and accordingly it is practicable to obtain the a.c. supply for the amplifier from the voltage transformer itself. In the event of a transient loss of supply to the magnetic amplifiers, as the result of a severe fault on the power system, the buck field would receive no excitation, leaving the boost field to force the amplidyne to its maximum positive output. This is, of course, the correct reaction in these circumstances. On recovery of voltage, the magnetic amplifier is once again able to establish full control and re-establish normal generator voltage.

Stabilisation of the system is principally by derivative feedback from the main exciter armature through a capacitor-resistor network, whilst direct negative feedback from the amplidyne armature is also employed. The application of direct negative feedback does not in any way affect the accuracy of the equipment, as under steady-state conditions the output of the amplidyne is zero, and accordingly no standing biasing effects are encountered.

The block diagram of this equipment is shown in Fig. 11, the signal circuit time-constant of the rotating amplifier being for two amplidynes in this case. Where the power requirements exceed the capacity of one amplidyne, it is common practice to arrange for two shunt excitation circuits of the main exciter, each of which includes the

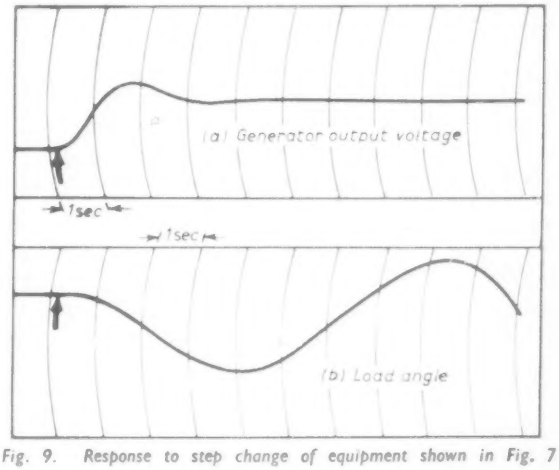


Fig. 9. Response to step change of equipment shown in Fig. 7

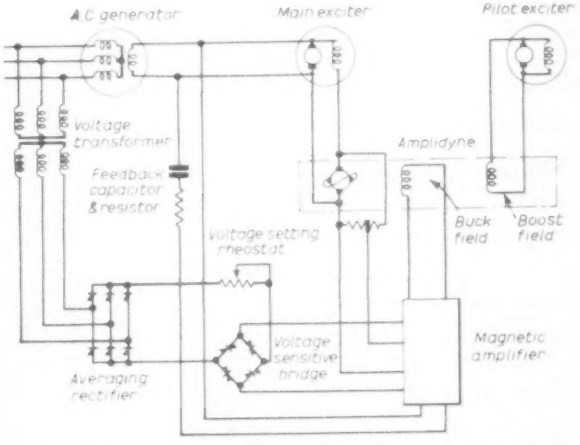


Fig. 10. Schematic diagram of Type VTSR 125A FR automatic voltage regulator with amplidyne

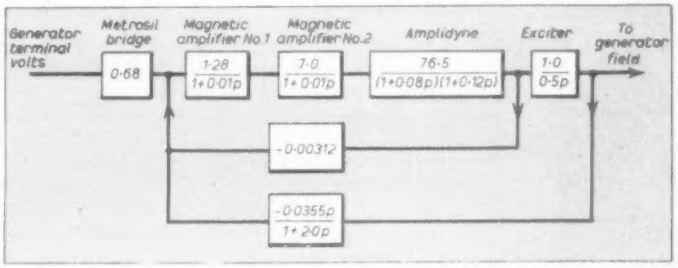


Fig. 11. Block diagram of a synchronous machine excitation system of type shown in Fig. 10

armature of an amplidyne. The signal coils of the two amplidynes are connected in series in such cases, giving a total signal circuit time-constant of 0·08 sec. Figs. 12(a) and 12(b) show the open-circuit transient response and load angle damping characteristic in the dynamic zone of this particular regulating system, whilst Fig. 16 shows the performance when rated load at rated power factor is rejected from a 100 MW steam turbine generator controlled by a single amplidyne buck boost exciter with the earlier flux-resetting magnetic amplifier regulator Type VTSR/152A.

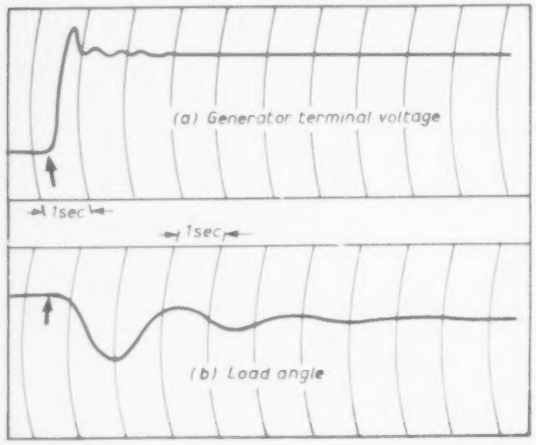


Fig. 12. Response to step-change of equipment shown in Fig. 10

In certain cases where very large machines are concerned, the excitation power required to achieve the required rate of response exceeds that of the amplidynes. In cases such as these it is common practice to employ a single amplidyne to feed the field of a fully laminated buck-boost exciter, which has its armature included in the shunt field circuit of the main exciter as shown in Fig. 13.

By extensive forcing of the buck-boost exciter field, a very low time-constant is obtainable for this machine and stabilisation is not a problem.

In addition to the feedbacks used before, a further direct negative feedback is taken from the buck-boost exciter field circuit, and the block diagram of the arrangement takes the form shown in Fig. 14. The corresponding open-circuit transient response and load angle damping characteristic in the dynamic zone are shown in Figs. 15(a) and 15(b), respectively.

Magnetic Amplifier Equipment for Medium Size and Large Machines

The Type VTSR/160 equipment, though involving more apparatus than the types employing rotary amplifiers, has been preferred by some authorities because of its more static nature. The arrangement is shown in Fig. 17, from which it will be seen that the voltage-sensitive Metrosil bridge feeds a large push-pull magnetic amplifier, which derives its supply from an auxiliary high-frequency generator. The magnetic amplifier employs three stages of amplification and is arranged to feed buck and boost windings wound around the poles of the main exciter. As in the case of the VTSR/152A/FR equipment, the main exciter is arranged to be fully self-exciting at full load, so that the full output of the magnetic amplifier is available for control purposes.

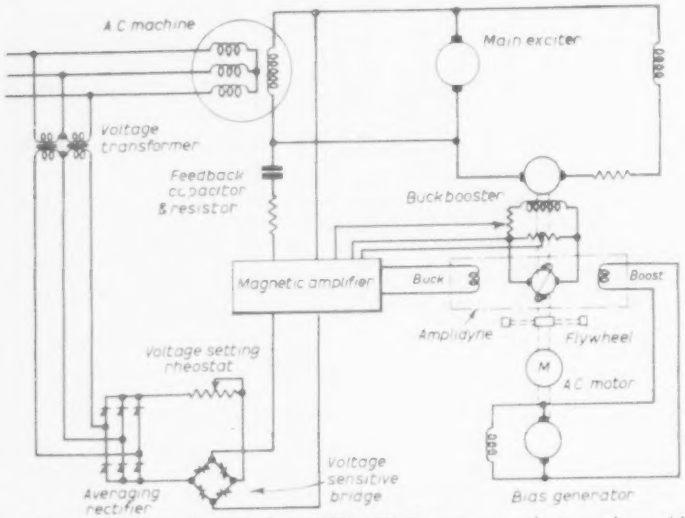


Fig. 13. Schematic diagram of type VTSR/152A/FR automatic voltage regulator with amplidyne and buck-boost exciter

The magnetic amplifier used is of extremely low time-constant and accordingly the arrangement to stabilise the system is simple and takes the form of a derivative feedback from the exciter armature only, a capacitor-resistor network being employed.

The block diagram of the arrangement is shown in Fig. 18 and it will be noticed that the main exciter field time-constant has the rather large value of 2·25 sec. This time-constant, of course, could be reduced by increasing the degree of forcing of the buck and boost fields, but this in turn would raise the power level of the output transductors as the peak ampere-turn requirements of the buck and boost fields are determined by the exciter ceiling which has to be reached.

Figs. 19(a) and 19(b) show, respectively, the open-circuit transient response and load angle damping characteristics in the dynamic zone.

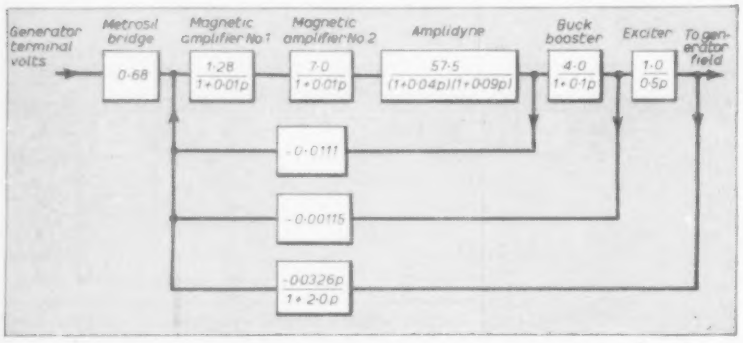


Fig. 14. Block diagram of synchronous machine excitation system shown in Fig. 13

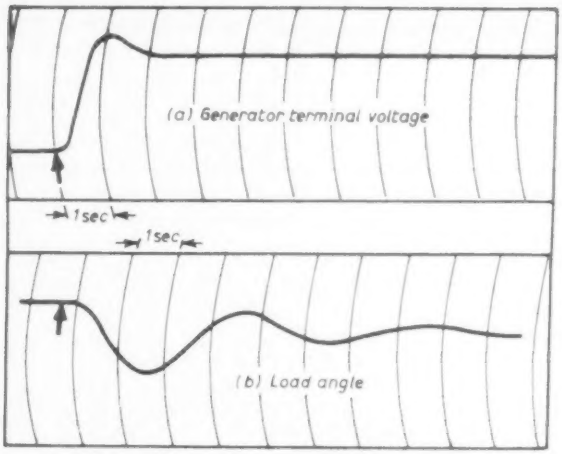


Fig. 15. Response to step-change of equipment shown in Fig. 13

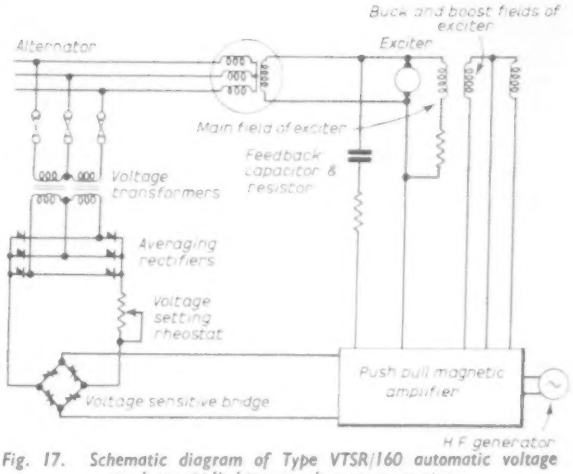


Fig. 17. Schematic diagram of Type VTSR/160 automatic voltage regulator applied to a synchronous generator

Under-excited Power Limit Unit

Whereas, as has been described, the modern automatic voltage regulator considerably increases the stability limits of steam turbo-generators, this in itself provides no guarantee that the under-excited reactive power demand on a machine may not, under certain circumstances, reach such proportions that overheating or loss of stability may ensue. Accordingly, the under-excited reactive power limit

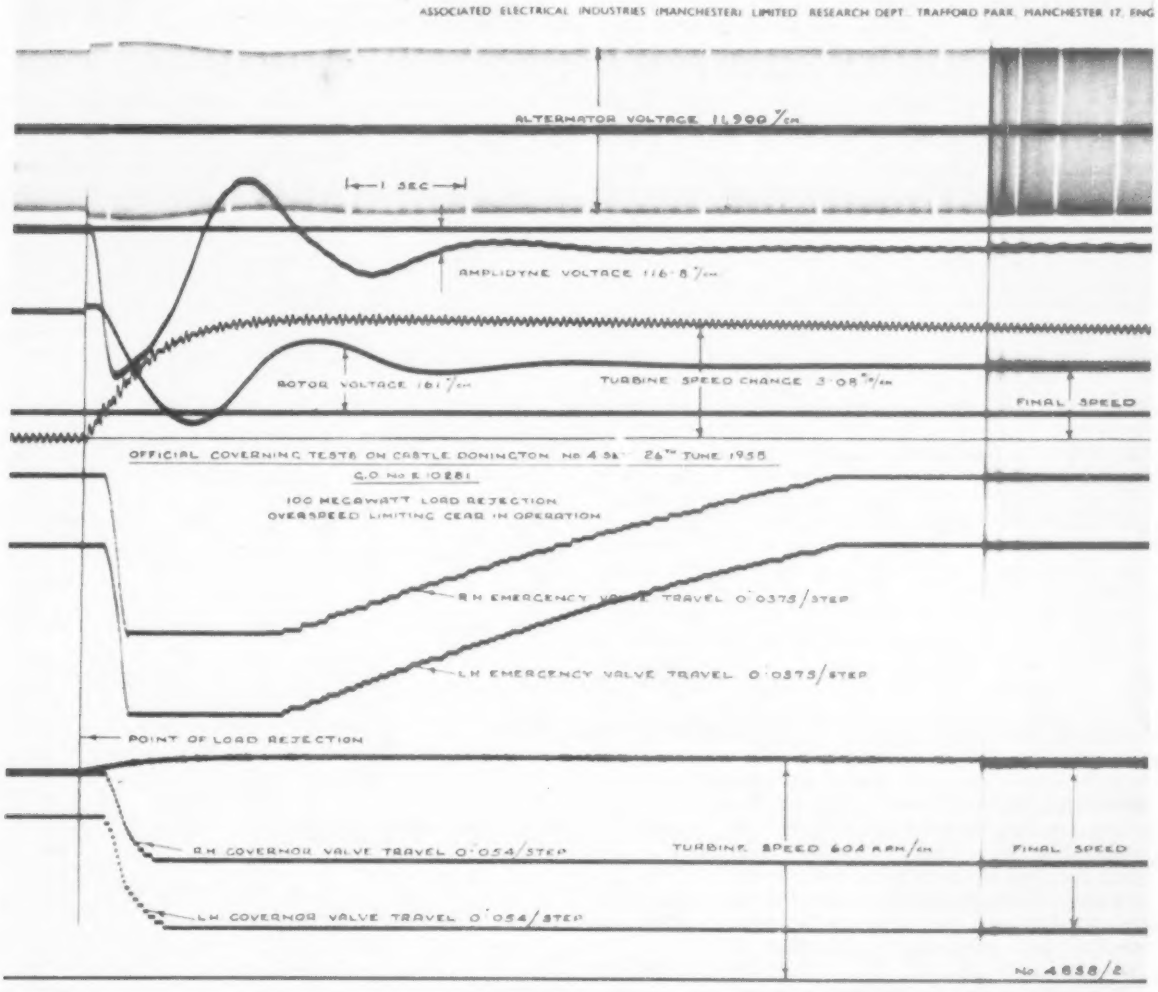

ASSOCIATED ELECTRICAL INDUSTRIES (MANCHESTER) LIMITED RESEARCH DEPT. TRAFFORD PARK MANCHESTER 17. ENG
ALTERNATOR VOLTAGE 11,900 V/cm
1 SEC
AMPLIDYNE VOLTAGE 116·8 V/cm
ROTOR VOLTAGE 181 V/cm
TURBINE SPEED CHANGE 3·08 rpm/cm
FINAL SPEED
OFFICIAL GOVERNING TESTS ON CASTLE DONINGTON No 4 Set 26TH JUNE 1955
C.O. No E 10281
100 MEGAWATT LOAD REJECTION
OVERSPEED LIMITING GEAR IN OPERATION
R.H. EMERGENCY VALVE TRAVEL 0·0375/STEP
L.H. EMERGENCY VALVE TRAVEL 0·0375/STEP
POINT OF LOAD REJECTION
R.H. GOVERNOR VALVE TRAVEL 0·054/STEP
TURBINE SPEED 604 R.P.M./cm
FINAL SPEED
L.H. GOVERNOR VALVE TRAVEL 0·054/STEP
No 4658/2

Fig. 16. Performance of 100 MW steam turbine generator when rated load is rejected at rated power factor with generator controlled by single-amplidyne buck-boost exciter using flux-resetting magnetic amplifier regulator

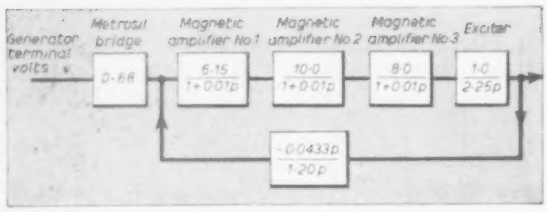


Fig. 18. Block diagram of synchronous machine excitation system shown in Fig. 17

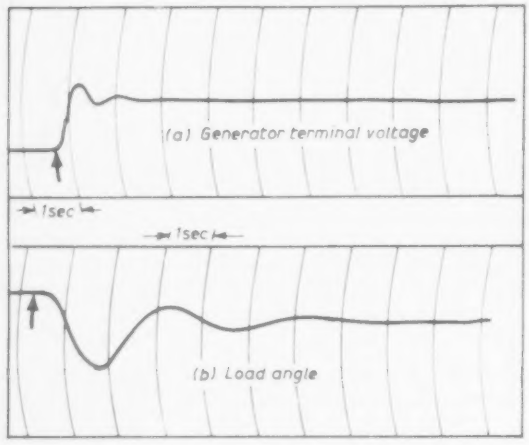


Fig. 19. Response to step-change of equipment shown in Fig. 17

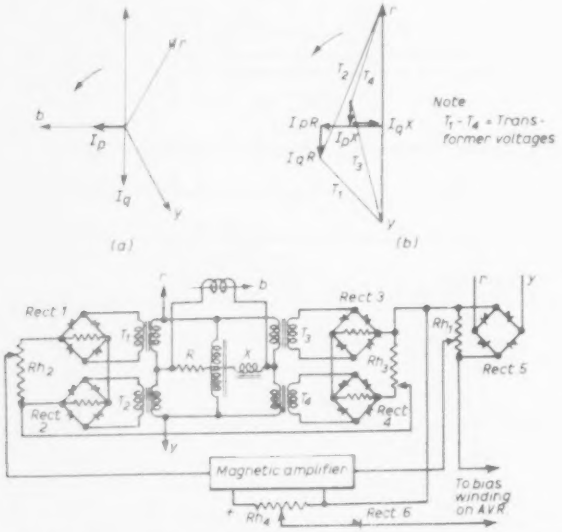


Fig. 20. Schematic diagram of type VTSR/152L limit unit with vector diagrams to illustrate operation

unit has been devised to ensure that predetermined limits of under-excited reactive power are not exceeded in operation. In setting these limits, consideration should be given to steady-state stability both before and after switching operations, as well as to the requirements for ensuring transient stability and preventing end-heating of generator stator iron.

The under-excited limit unit acts to prevent the automatic voltage regulator from reducing the excitation of the machine below a preset value, the allowable maximum under-excited reactive power being variable with the active power output of the generator if so required.

The limit unit obtains its alternating current supply from the main generator itself, the voltage from one pair of phases being employed whilst current is taken from the quadrature phase. Fig. 20(a) shows the vector diagram of the supplies, the voltage used in this case being r-y. The currents I_p and I_q are the in-phase and quadrature components, respectively.

The principal components of the under-excited reactive power limit itself are shown in Fig. 20 and include a centre-tapped auto-transformer, together with resistance R, reactor X and isolating transformers T_1, T_2, T_3 and T_4. The voltages from the secondaries of transformers T_1 and T_2 are applied to a reactive power discriminating circuit, consisting of rectifiers 1 and 2, together with their resistors, and the potentiometer Rh_2. The voltages from the secondaries of transformers T_3 and T_4 are applied to an active power discriminating circuit consisting of rectifiers 3 and 4 and the potentiometer Rh_3. For the case of a generator carrying under-excited reactive power the signals obtained on potentiometers Rh_2 and Rh_3 are additive and are compared with a reference signal derived from the phase-to-phase voltage of the generator itself, this being displayed as a proportionate direct current signal on the potentiometer Rh_1. Included in this circuit is the

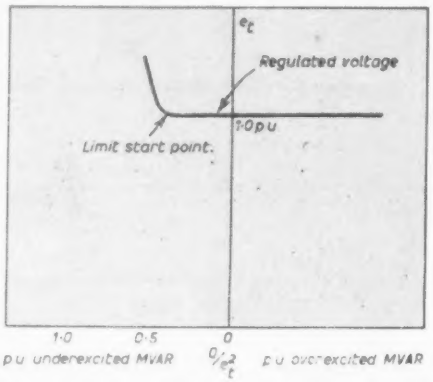


Fig. 21. Typical terminal-voltage/MVAr characteristic of a synchronous machine with type VTSR regulator and associated type VTSR/152L limit unit

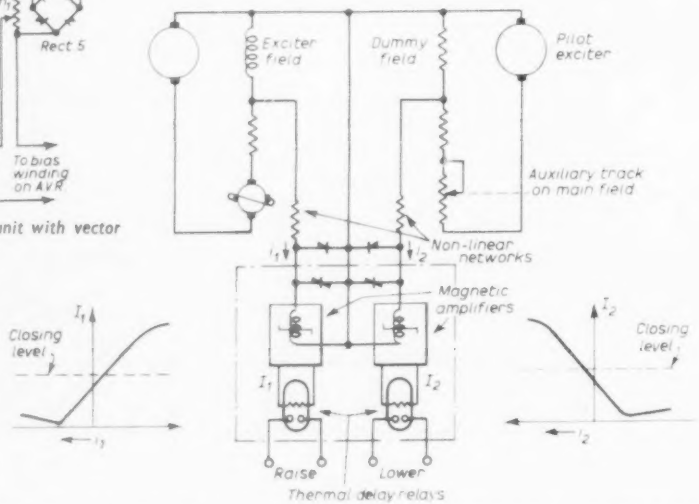


Fig. 22. Schematic diagram with characteristics of a follow-up scheme employing a type VTD differential relay

signal winding of a magnetic amplifier which has the potentiometer Rh_4 for its load. A bias winding on the automatic voltage regulator itself is introduced to a circuit which includes the potentiometer Rh_4 of the limit unit magnetic amplifier, a blocking rectifier 6 and the generator terminal voltage reference which is present as an equivalent direct current on the potentiometer Rh_1.

When the under-excited reactive power limit is exceeded, the sum of the voltages picked up from the potentiometers Rh_2 and Rh_3 exceeds that taken from the reference potentiometer Rh_1. Under these conditions the output of the magnetic amplifier rises sharply until the voltage taken off from the potentiometer Rh_4 exceeds that across the potentiometer Rh_1. Current now flows through the blocking rectifier 6 and the bias winding on the automatic voltage regulator in such a direction as to force the regulator to raise the regulated voltage until its effect is neutralised by the increased output of the voltage-sensitive bridge of the regulator. Operation of the limit unit can be explained by reference to the vector diagram, Fig. 20(b). The voltage r-y on the centre-tapped auto-transformer acts as a limit circuit reference, whilst the input current from the b phase can be resolved into two components, the in-phase component being I_p and the under-excited reactive component being I_q. The vector diagram shows the voltage components produced by the in-phase and quadrature components of current circulating in the limit circuit resistor R and reactor X. It will be seen that in so far as the output of the transformers T_1 and T_2 is concerned, the component I_pR is of little significance and can be neglected. Similarly, in relation to output of T_3 and T_4, the component I_qX is of little significance and can be neglected. Accordingly, the effective output of transformers T_1 and T_2 is I_qR, whilst that of transformers T_3 and T_4 is I_pX.

Since the under-excited reactive power limit unit commences operation when the sum of the signals on Rh_2 and Rh_3 is equal to the signal on Rh_1 we have:

$$Ke_t(r-y)=I_qR+I_pX \quad .. \quad .. \quad (1)$$

Equation (1) may be rewritten:

$$I_q=K_1 e_t(r-y)-K_2 I_p \quad .. \quad .. \quad (2)$$

Where $K_1=K/R$

$K_2=X/R$

Equation (2) may be represented as:

$$Q/e_t^2=K_1-K_2(P/e_t^2) \quad .. \quad .. \quad (3)$$

Where $Q=I_qe_t$=reactive power

and $P=I_pe_t$=active power.

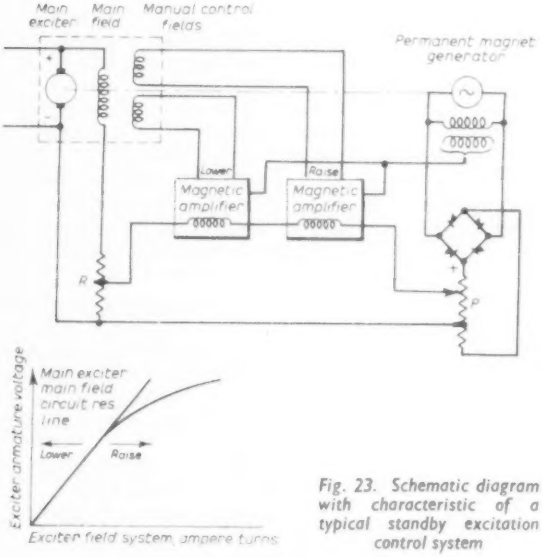


Fig. 23. Schematic diagram with characteristic of a typical standby excitation control system

A typical limit-start curve related to actual machine characteristics is included in Fig. 3. Fig. 21 shows the limit-start point related to the setting indicated in Fig. 3, and it will be seen that there is no influence on the regulated voltage until this point is reached. Any further attempt to increase the under-excited reactive power on the machine is automatically countered by an increase in the terminal voltage e_t, the under-excited capability rising proportionally to the square of the terminal voltage.

Follow-up Device

Where large machines are involved it is desirable that when on automatic control the standby excitation system is automatically adjusted so that should it be necessary to change back rapidly to standby excitation, no dangerous change of excitation will result.

The arrangement shown in Fig. 22 is typical and covers the case of the standby pilot exciter, which under non-automatic excitation control, involves separate excitation of the main exciter field through a field rheostat. When on automatic control, the pilot exciter is connected through an auxiliary track on the main exciter field rheostat to a dummy field resistance. The object of the arrangement is to provide on the dummy field resistance a voltage which would for any given rheostat position equal that on the main exciter field when the latter is fed from the pilot exciter.

A differential relay Type VTD employing magnetic amplifiers is commonly used for this service, the loads of the push-pull connected amplifiers being in the form of two thermal time-delay relays. The magnetic amplifiers have their signal circuits so connected as to react to the differential of the voltages of the main exciter field and dummy field resistance.

Standby Excitation

On the very large machines being built at the present time, the excitation power of the main exciter itself is frequently so great as to warrant consideration of standby excitation systems alternative to the traditional separately-excited arrangement employing a direct current pilot exciter and field rheostat.

An alternative system that has been used successfully is shown in Fig. 23 and involves the use of a permanent magnet type of pilot alternator instead of the conventional pilot exciter. Low power buck and boost control fields are wound round the poles of the main exciter, and are respectively energised by lowering and raising magnetic amplifiers of corresponding capacity. The main field of the exciter is shunt connected, the overall circuit resistance being such that at full load full self-excitation is obtained.

A supply is taken from the permanent magnet alternator which, after rectification, is applied to the reference potentiometer P. A voltage is taken from the main exciter field-forcing resistance R, and is compared with that on the slider of the reference potentiometer P. Any differential between these voltages gives rise to a current flowing one way or the other through the signal coils of the magnetic amplifiers with corresponding buck or boost output to the standby control fields. The arrangement itself comprises a low gain main-exciter voltage regulating system of extreme simplicity. Accordingly, the armature voltage of the main exciter, which itself is proportional to the voltage taken from the resistance R, is controlled by the position of the slider on the reference potentiometer P.

Acknowledgment

The assistance of the AEI Power Systems Engineering Department in carrying out analogue computer studies is gratefully acknowledged.

Readers Views

Correspondents writing under pseudonyms are asked to submit their names and addresses in confidence to the Editor

Heat Pumps for Offices

I HAVE now consulted my Committee on Mr J. C. Edwards' letter referring to our report on heat pumps in power station office buildings (ELECTRICAL TIMES, 20 October).

Your correspondent makes three points:

1. The floor-warming installations included in the survey carried out by the sub-committee were less efficient than other installations for which data are available.

2. The electrode boiler system studied was over-sized for its job, and was situated in a separate boiler house rather than in the basement of the building to be heated. It is implied that the heat pumps used for comparison were situated internally. The results obtained for the electrode boiler studied are, therefore, stated to be unrealistic.

3. The sub-committee's conclusions apply to continuous heating and not to intermittent heating and, therefore, should not be applied to office buildings.

As stated in the Terms of Reference, the sub-committee were interested primarily in methods of heating the administrative offices of generating stations, with particular reference to the use of the heat pump. It is considered that the report contains sufficient information to enable the serious reader to correct the values quoted for other conditions such as different system efficiencies and temperature variations.

The office blocks used were of simple shape, two or three storeys high, and it was considered necessary for various reasons to heat them continuously. The heat losses were calculated using one air change per hour, as this was considered to be more appropriate than 1·5 or 2·0. This point is stressed because values of consumption and calculated heat loss are often quoted without giving this information.

Taking the three points raised in order:

1. Mr Edwards quotes a figure of 2,240 kWh per annum per kW of calculated rate of heat loss, obtained in other tests, as a criterion of efficiency for floor-warming. I understand that the rate of heat loss used in these other tests, however, corresponds to 35°F temperature difference and not to 31°F temperature difference as taken in the present report. Figures taken from this report lead to the following:

		Electrode boiler with thermal storage (Meaford "B")	*Floor-heating (Bold)*
1.	Observed annual consumption ..	304,224 kWh	250,727 kWh
2.	Rate of heat loss for 31°F rise ..	85 kW	96 kW
3.	Rate of heat loss for 35°F rise ..	96 kW	109 kW
4.	Observed temperature rise	17·5°F	19·6°F
5.	kWh/kW (35°F) for observed temperature rise	3,169	2,300
6.	25-year mean temperature rise ..	23·0°F	23·0°F
7.	kWh/kW corrected for 23°F temperature rise	4,160	2,690

These values, 4,160 and 2,690, are those which should be compared with the value of 2,240 kWh/kW quoted. Recourse to the report on electric floor-heating installations referred to by Mr Edwards (ERA Report Ref. Y/T/26) indicates, however, that a better value for the latter would be 2,450 kWh/kW and on this basis, the Bold installation does not show up so badly.

2. The electrode boiler with thermal storage was a new plant and was installed by reputable heating engineers. As stated in the report, however, the installed loading of 300 kW was reduced to 212 kW in the final calculation (i.e., 85 kW by 2·5) because it was considered by the sub-committee that the capital cost was unnecessarily excessive.

The observed consumption for the electrode boiler given in the full report (Appendix D(b) 33), is a straightforward meter reading and the mean temperature observed (65°F) in the building is reasonable. The sub-committee noted the low efficiency of the system but could only explain it, with the information at their command, by the fact that the boiler house was separate from the heated building and that mains losses were responsible for the low efficiency.

Mr Edwards criticises the sub-committee for using such an installation in the comparison, but it must be pointed out that both heat pumps were also in separate buildings and subject to mains losses.

Mr Edwards' calculated consumption for the electrode boiler at Meaford uses values incorrectly quoted from the report and also assumes 100% efficiency for the plant. The true values are as follows:

Heat loss at Meaford "A"	4·24 kW/°F rise
Actual mean inside temperature	70·5°F
Actual mean outside temperature	48·2°F
Observed mean temperature difference	22·3°F
With allowance for stray heat of 3°F	19·3°F
Hours for continuous heating per annum ..	5,040
Annual consumption for 100% efficiency (5·040 × 19·3 × 4·24)	412,000 kWh
Cost at 0·85d (100% efficiency)	£1,460
(90% efficiency)	£1,620
Cost at observed 66·5% efficiency	£2,188

The annual charges, for the electrode boiler with reduced loading, for capital cost plus attendance, maintenance and the peak charges for pump consumption, were £674.

If the electrode boiler was operating at 90% efficiency, the overall operating costs for continuous heating in commercial buildings would be £1,620+£674=£2,294, and it would still keep its place in the table as the most expensive system.

For continuous heating the boiler has to supply (85 times 24) kWh plus losses. If this has to be provided with only 15 hours availability of supply, the loading must be 151 kW, assuming 90% efficiency. With only 66·5% efficiency, as observed, the necessary loading would be 205 kW. As stated above, the sub-committee's calculations were based on 212 kW, a sufficiently close approximation. For 90% efficiency the annual capital charges would thus have been dropped by £149, bringing the overall annual costs to £1,620+£525=£2,145. Again the electrode boiler would be placed in the bottom bracket of the table.

3. Since the sub-committee only studied continuous heating systems it would have been wrong to adjust the findings to provide conclusions applying to intermittent heating. It was hoped that the report made this clear, but the fact that Appendix "F" and Conclusion II of the full report apply only to continuous heating could, perhaps, have been more explicit.

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Space-heating control

METHODS SUMMARISED AT A.S.E.E. MEETING

ALL space-heating systems, regardless of whether they be electric, gas, hot water, steam or plenum, require some form of monitoring and control. Because of the lag in time between the sensing of a change in room conditions and its rectification by a change in the heating arrangements there is bound to be local fluctuations in ambient temperature; moreover, since the heating source —except in the case of embedded wall-heating—is localised at one or more points in the room, there must also be a temperature gradient in the room as well.

In an effort to reduce both the fluctuations and temperature gradients in space-heating installations, considerable study and experiment has taken place over the years, as a result of which a number of control systems, in the main electrically sensed and operated, have been devised. At the Association of Supervising Engineers in London last Tuesday, 20 December, Mr D. H. Powell presented a paper* describing the main principles of the more widely used control systems.

Fundamentally, the objective is to determine the required room temperature (and/or humidity), select a measuring unit which can sense changes from the temperature and to link the measuring unit and the temperature control device either mechanically or electrically. The measuring unit may be mechanical—bi-metal, rod and tube, sealed bellows, phial filled with gas or volatile fluid, etc.—or electrical, such as a thermo-couple or resistance element. Mechanical units may use the power developed on deviation directly to actuate the temperature control device or it may close electrical contacts associated with a solenoid, motor or other electrical device. The control unit may be a motorised valve, solenoid-operated valve or just a switch in an electrical heating circuit. For high sensitivity the measuring unit should have small mass, which is a disadvantage in the purely mechanical units since small mass means small operating power. With electrical sensing units the mass may be as little as one-hundredth of that of the smallest mechanical device and accuracy combined with high sensitivity is easily achieved.

Control systems fall into two basic patterns: "on-off" and "proportional" or "modulating." In the former, the control or regulating unit has two positions only, open and shut; in the latter, the unit may be adjusted to stop at any intermediate position which is proportional to the deviation from the selected temperature of the ambient conditions.

External Factors

Factors affecting the variation in ambient conditions which have to be compensated for by the system include building usage, external temperature changes, variations in wind direction and velocity, solar radiation, occupancy, presence of machines or processing equipment, lighting, room size, shape and wall construction and position of room in the building. Rooms at the top of a building are more susceptible to cooling by external winds and heating by solar radiation with extremes on southerly facing rooms or those meeting the prevailing wind direction. The presence of lift-shafts may result in the accumulation of hot air from lower floors at upper levels.

All of these factors have to be considered when planning an installation and the usual practice is to break the building up into zones, each with its own separately calculated heating load and, in today's taller office buildings, the proper zoning is an important factor in economic planning of the heating installation. The zoning must be done both horizontally and vertically. This will give a rough thermal distribution pattern which will be subject to seasonal and morning-to-night variations. The finer control is applied by the thermostats sensing the local conditions and adjusting the regulators.

"On-off" Systems

Taking first the simplest of "on-off" systems incorporating electric heating, the thermostat would be in the form of a snap-action "on-off" switch which makes and breaks the actual heater circuit. The operating element may be a bi-metal strip or gas-filled bellows but, since the load may be up to 5 kW, or 25 A, the contacts in the thermostat must be robust enough to carry the current without adding to the heating effect of the device. This calls for rugged mechanical devices which will lack sensitivity and, moreover, will have a fair differential between opening and closing temperatures.

In an alternative form, the contacts are of light construction and take only a few milliamps, the closing current of an associated relay which, in turn, controls the load current. The action, on an a.c. circuit at low voltage derived from a transformer, need not be q.m.b., with the result that both sensitivity and temperature differential can be improved. A further step to improve differential is to apply "heat anticipation," a device which provides local artificial heat to the thermal element of the sensing unit when in the off position, so flattening the overshoot inherent in two-position control.

The "on-off" control described can also be applied to non-electric heating systems, the flaps or valves being operated by solenoids or motors. Where motors are used, these are usually of the uni-directional type, being so geared to the valve-operating shaft as to make half a turn of the shaft each time. Once started by the closing of the switch, the motor continues to turn until stopped by the 180° limit switch, a local switch ensuring that, once started, it will not stop, even if the thermostat circuit is interrupted, until the limit position is reached. The thermostat switch, of course, has to be a change-over switch, energising the motor to open or close. The circuit is such that the opening and closing circuits can only be energised by the right position of the thermostat contacts. An alternative form is one in which the motor is a reversible capacitor type in which the thermostat contacts connect the capacitor

* "Electrical Control of Heating and Air Conditioning Plant."

to either one or other of the two windings to control the direction of rotation.

Proportional Control

Proportional control enables mid-position settings of the valves to be selected so that the full heating effect is not applied for small variations in ambient temperatures. A basic pattern similar to the last-described form of "on-off" control can be adopted with the reversible motor devoid of its maintaining switch. That is to say, the motor will run in either direction just so long as the thermostat contacts are closed and will stop in a suitable intermediate position corresponding to the neutral zone of the controller. Limit switches ensure that the motor stops in the extreme open and closed positions. For such a system to operate there must be a very rapid response in the thermostat area to the heating effect of the changed valve position. Alternatively, the operational speed of the motor must be slowed down to prevent excess travel before the thermostat has had time to respond. In practice, both thermostat and motor speed are selected to give the required result.

For greater sensitivity, proportional control, using potentiometer or bridge circuits, are applicable. In the simplest form, the moving contact on the potentiometer is shifted by the thermostat to positions which correspond to the temperature setting as sensed by the thermostat element. A valve setting corresponding to this temperature is obtained by a reversible motor which is also coupled to the moving contact of a second, similar potentiometer. With both potentiometers in parallel across the supply, the motor or, alternatively, a reversible relay controlling the motor is connected across the two moving contacts such that, when the contacts are in matching positions, no current flows in the motor or relay circuit. At other times the current flows in a sense which will turn the motor to open or close the valve and simultaneously drive its potentiometer contact to the balancing point.

The potentiometers are, in fact, connected in the form of a bridge circuit. Other systems employing bridge circuits use a resistance element of high temperature/resistance coefficient as the sensing element in one arm of a conventional bridge with a potentiometer coupled to the valve motor in the balancing arm, the motor being controlled by a relay across the bridge. The relay may be a sensitive electronic device with a high amplification factor or just a simple galvanometer movement, depending on the closeness of control required. Adjustment of the thermostat is by an adjustable resistance, or rheostat, in series with or across the resistance element.

Sometimes it is desired to adjust the setting automatically in step with variations in external conditions, such as a change in outdoor ambients. This may be effected by other h.t./r.c. resistance elements in series with the indoor sensing elements in the same leg of the bridge, the secondary elements being located at external points where they can sense the change in ambient conditions.

Air-conditioning

Air-conditioning installations also cater for changes in humidity as well as temperature and, in the modern installation, allow for cooling as well as heating of the air. Installations which cater for heating and cooling but not humidity control are erroneously called air-conditioning systems in some quarters. Cost and space limitations are outmoding air-washing plant in favour of cooling plants employing direct-expansion cooling coils, but this introduces problems on large-capacity plants. A recent development in the larger buildings is the provision of centralised control consoles under the observation of an engineer who, from his position, can assess the requirements throughout the building from information presented to him on his instruments, and can adjust the settings of the valves, fans and heating or cooling equipment to meet the conditions by remote push-button control.

Mr Powell illustrated his paper by a number of circuit diagrams and illustrations of equipment.

Rail Traction Troubles

TROUBLES with electric trains in Scotland were the subject of a public inquiry which opened in Glasgow. It was conducted by the Chief Inspecting Officer of Railways and those attending include Mr F. J. Lane as a partner in Preece, Cardew & Rider, consulting engineers, making an independent investigation for the B.T.C.

Early evidence at the inquiry was concerned with five incidents involving transformers on the multiple-stock units in Scotland. The explosion which injured several people was one of these; in that case, the guard of the train had asked "for the re-set of the pantograph on one unit." Shortly after this was done, the explosion occurred.

After the explosion, the transformer concerned was "badly bulged." Another incident occurred before the trains went into public service. On a trial run after a driver had experienced trouble running through a neutral section of line between a 25 kV section and a 6·6 kV section, there was an explosion and doors were blown off the guard's van.

After the incident in which passengers were injured, all-night work to modify the trains was carried out. Later, there were more explosions involving transformers, and although these did not injure anyone because of the effectiveness of the modifications, they so damaged the transformers beneath the train that a risk became apparent that the track might be damaged.

The inquiry was continuing as we went to Press.

In a statement issued by BEAMA on behalf of manufacturers before the inquiry opened, it was said that they shared British Railways' concern at the inconvenience the failures had occasioned to the public, both in respect of the Scottish incidents and those on Eastern Region of British Railways. However, British Railways and the manufacturers, working in partnership, were engaged in the introduction of railway electrification schemes employing the most advanced techniques under conditions which were not paralleled in any other country.

The new h.v. system used had been adapted to a densely loaded suburban and main-line system, with conditions of heavy pollution and special clearance problems in tunnels and station areas. Within two months, more than 600 miles of lines had been commissioned on the h.v. system.

It was a basic problem of railway systems, the BEAMA statement added, that complex works had to be carried out whilst maintaining full services. The new equipment was intensively tested by manufacturers and BR under trial running conditions, but, with so many different factors involved, the final proving was only possible when the complete equipment was operating in a single system.

British Railways had earlier stated that discussion with manufacturers of electric traction equipment for all regions had been held, and a definite assurance was possible that the type of trouble with transformers experienced in Scotland could not occur elsewhere.

NOTES ON WIRING

BY MEGOHM

SOON 1960 will be behind us, and like everybody else I pause to look back on its events, and the matters which concern me and these notes. The first thing which occurs to me is something of a problem which seems to be with us for ever—adequate wiring. Only in isolated instances have we seen any attempt to convince people that ample sockets are required in the modern home. Electrical apparatus for the home is increasing in number and variety every month, smokeless zones are being created more rapidly in an effort to improve health conditions and the housewife is now deluged with tempting offers either in the newspapers or in visual form over the ether. But still those responsible for planning houses are not co-operating, even after all the efforts by electrical engineers, manufacturers and the Press.

Naturally, the 13 A socket and the ring circuit figured amongst my comments during the year and I have even had letters to the effect that the 13 A plug and socket is not as perfect as it should be. Complaints of the plug working loose from the socket due to vibration, etc., were, after investigation, not so unbelievable as they seemed at first. One plug, readily available to the public, which was shown to me, had completely blown up when inserted into a socket, and an examination of another of the same make showed a distinct weakness where the fuse carrier was connected to the live pin of the plug.

One very good modification to plugs by a certain manufacturer received widespread praise. This was the use of captive washers on the terminals and I feel that electricians everywhere must have muttered a grateful "thank you" to this firm.

Specifications and Contracts

Many specifications for house wiring continue to resemble a skeleton and the young house buyer often falls into expense due to the "extras" charged for outlets which are necessary for comfortable living. One house in Kent, price £2,500, had three 13 A sockets allowed for, yet the brochure stated ". . . the standard house is complete in itself and there is no need for extra fitments."

On the other hand, comments reached me about the apparent inclination for contractors to forget the "loose ends" on an installation. Circuit lists, record drawings, etc., are forgotten (conveniently) and a lot of time is wasted by the client or consulting engineer trying to prise these out of the contractor. This sort of thing leaves a bad taste on the work and I have had to get really tough with such contractors. Once, and once only, I even had to goad the contractor to render his final account!

M.C.B's Exhibition

Just before the Electrical Engineers Exhibition opened at Earls Court in April, I saw the prototype of a consumer's unit fitted with m.c.b's and a range of flush and surface fuseboard units similarly equipped. These were really well designed units and received much attention at the exhibition.

The exhibition itself was a success but there were mixed feelings as to whether it should continue to be an annual event or whether it should have a rest between shows. I feel that too much depends on the introduction of something "new" by manufacturers. Many engineers visiting the exhibition would do better by increasing their knowledge of existing apparatus and widening their ideas a bit.

Goods from Overseas

Two disturbing matters arose from apparatus and accessories imported from abroad. The first of these was the matter of the colours used in the flexible cables on apparatus and the dangers if these are not checked before the apparatus is put into use. This matter received a lot of necessary publicity and gradually resolved itself. I, myself, had one or two brushes with small shopkeepers who were not very concerned about the whole thing. The other matter was the unrestricted importation of electrical accessories from the "Empire." The need to live with this evil of offering accessories to the public has been the subject of much discussion. We engineers can help a lot by stating our views and pointing out that really first class British made accessories do not cost so very much more than these "Empire" goods.

One British made article did annoy me and that was the glass-case fuse which so many small electrical traders and chain stores sold as being suitable for use in 13 A plugs. I must extend my thanks to the many manufacturers who instructed their representatives to contact the people concerned and put the matter right. These fuses can be extremely dangerous under short-circuit conditions.

Trunking

This year I made my acquaintance with a very fine type of trunking which has certain commendable features. One is the fixings for the lids which are fitted on site and avoid the usual trouble with screws and possible bending of the cover lid. Also, the 90° type fittings have special internal radiused corners to avoid dragging and cutting cables. The jointing of the sections is also unique and very simple too. The firm also manufacture sheet steel cubicles and cabinets. I actually assisted one site operative to erect some of the trunking and saw how easy it was to fit.

Tenders

Fixed price tenders were more in evidence this year and I feel that we shall hear more of them next year. The pending increases in electricians' wages will affect contracts just starting, and it will be interesting to see how many contractors press claims on contracts which overrun the set completion date. As I understand it, the substantial increase granted to electricians came as a bolt out of the blue and could not have been anticipated whilst preparing tenders.

So, on to 1961, with its unknown shocks, surprises and pleasures. Let us hope that it brings forth better understanding amongst men and that "Prosperity" becomes the keynote in the electrical industry.

To all my readers I send my thanks for your past interests and my wishes for good health in 1961.

Highlights of 1960

ELECTRICAL INDUSTRY EVENTS REVIEWED

WHEN the electrical industry thinks back on 1960, it will recall boom selling collapsing through Government-imposed hire-purchase restrictions, major plans for technical advances in electricity supply and the inauguration of the rail electrification programme, followed by its intensive examination from the financial aspect.

It is supply and the manufacturing effort behind it which must have pride of place for 1960. Orders were placed for the first supercritical steam conditions sets and for the first equipment for the future 380 kV (now to be 400 kV) contribution to the supergrid; local generation became established in the SWEB area; and, overseas, the majestic Kariba scheme began to produce power and was accorded the distinction of a royal opening.

Electricity Supply

For supply, the year opened with the ordering of a second 550 MW set for the Thorpe Marsh power stations, the unit differing from its companion through using a 1,500 r.p.m. l.p. unit. The next move of note was introduction of a clause in the bulk supply tariff to permit an allowance for large loads which consumers were prepared to interrupt at short notice, progress with the continuing philosophy of driving for load factor improvement through tariff design.

March saw another element in the future of electricity supply in the UK sketched in, with the announcement of CEGB plans for two 2,000 MW stations in the Midlands, one at Holme Pierrepont, the other at West Burton. The latter was accepted calmly enough, but the controversy about Holme Pierrepont from the amenity aspect continued to reverberate throughout the year.

In June the Electricity Council underlined the striking progress being made in electric off-peak storage heating, with an estimate that the total connected load in Great Britain exceeded one million kW. Analysis of the figures showed that floor-warming was overtaking block storage heating as the largest contributor to this valuable demand.

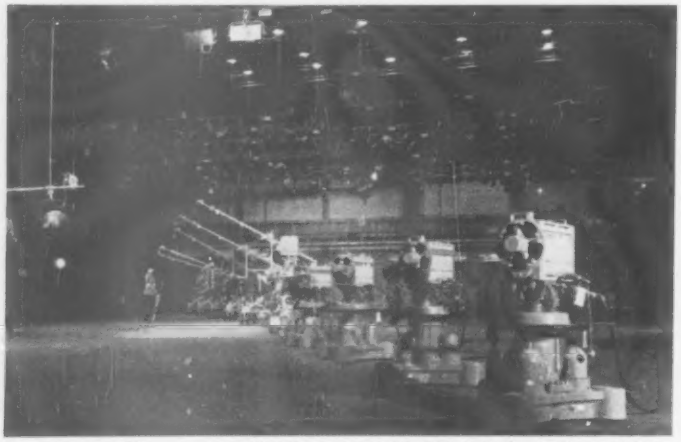
In August came the orders for supercritical-pressure boilers and sets, the first for the supply industry in the UK, although they had been in use in manufacturing industry. With one boiler, one turbine for 375 MW, the designs adopted set 3,500 lb/sq in., 1,100°F as the limits for this first excursion into a new field of steam conditions, and even higher thermal efficiencies—approaching 40%. But the move involved a warning as well. For the first time in recent CEGB technical advances, capital cost per kW went up, although more than offset by the expected improvement in thermal efficiency.

Dark spots on the supply prospect came at the end of the year. A coal price increase of 5s 1d/ton combined with a major wage increase to make some rise in the cost of electricity almost inevitable, and the very success of the industry overtook its capital-limited forward planning, so that at the very end of the year there have been warnings of possible load-shedding by reduction of voltage and frequency.

Nuclear Power

Of course, no review of supply progress can ignore nuclear generation, even though the first of the civil nuclear power stations will not begin generation until next year. In nuclear engineering, the major event was the long-heralded revised Government programme for nuclear power, which proved something of a damp squib when it was published in July, with its main proposal of a 5,000 MW limit up to 1968. This represented acceptance of the lower level of the 1957 revision, with a three-year postponement, a move which had long been apparent. However, forecasts, favourable to nuclear designs, of the relative cost trends of coal-based and nuclear generation began to appear during the year, notably in a paper by Sir Christopher Hinton and some of his colleagues, which was presented to a World Power Conference meeting in June and which predicted parity some time between 1965 and 1970 for high-load-factor stations.

Nuclear trade contraction had its effect on manufacturing arrangements. From five groups, the consortia tendering for nuclear power stations shrunk to three, due to the amalgamation of the AEI-John Thompson group with the Nuclear Power Plant Co. in January and the June agreement between GEC/Simon-Carves and the Atomic Power Constructions group. Two orders for nuclear stations were placed during the year, one for the 550 MW Dungeness station with the Nuclear Power Group (the earlier of the combined consortia)



Four of the ten TV cameras supplied for Associated-Rediffusion's Studio Five, which is claimed to be the largest television studio in Europe and the Commonwealth

and, more recently, that for Sizewell with the English Electric, Babcock and Wilcox, Taylor Woodrow consortium.

Looking to the future, the progress made with the advanced gas-cooled reactor at Windscale was one of the most significant events in the UKAEA year. Thermonuclear work continued at a slower pace and at a more fundamental level after the heady hopes for ZETA were abandoned and its successor, ICSE, was postponed. Further away still is a gas-cooled reactor for the sort of temperatures that can be used with gas turbines, and here a start on practical experimentation was made at Winfrith Heath in the Dragon project, in which several European countries are co-operating.

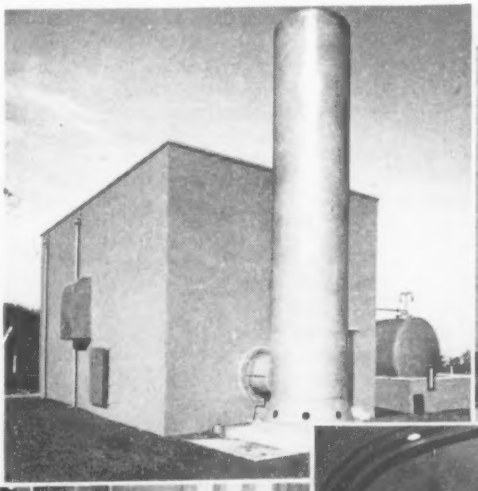
Overseas

Electricity supply overseas deserves a note, especially on account of the successful start-up of the 1,200 MVA ultimate-capacity Kariba scheme, with its impounded lake covering a surface of some 2,000 square miles. The station first generated at the very end of 1959, but the landmark of the year was its formal opening by HM Queen Elizabeth, the Queen Mother, in May.

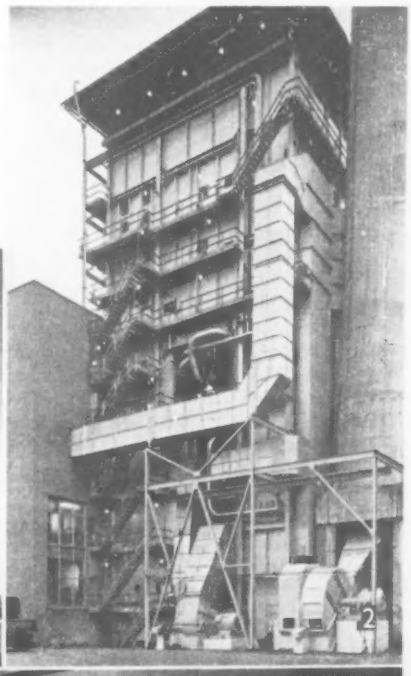
In the field of promise rather than achievement, the endorsement by consulting engineers of a plan for a 500 kV d.c. submarine cable link between the north and south islands of New Zealand made an exciting announcement in April. The plan was to provide for 600 MW capacity, operating at 250 kV to earth. Another scheme for the future was that for a Volta River dam and hydro station, long contemplated for Ghana, which took a step forward in August with provisional agreement of financial terms with the world banks and the US and UK Governments.

Contracting Topics

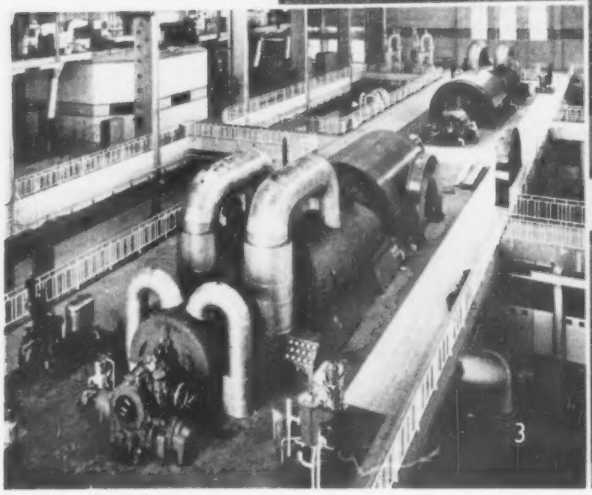
The early part of 1960 was marked by a burst of public statements on what constituted adequate wiring. These were inspired by the request for views made by a Ministry of Housing-based committee which was examining the whole question of housing standards. The report of the committee is still awaited, but from the evidence an "official" electrical view of what was the minimum acceptable installation became apparent. This involved six sockets



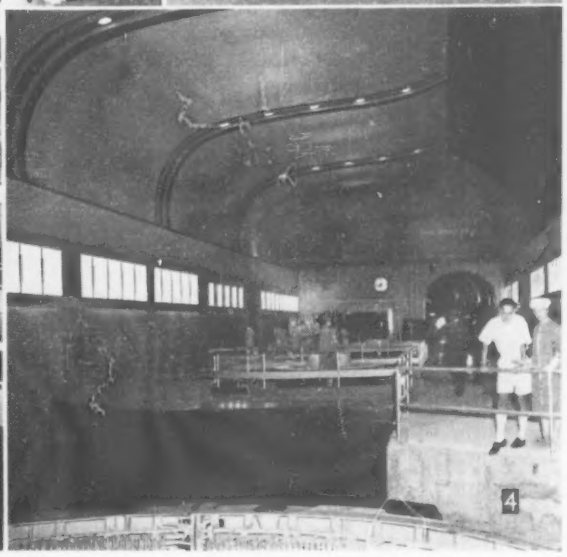
1. Bristol Siddeley 3 MW gas turbine generator station for South Western EB at Lynton for peak generation



2. Supercritical-pressure Benson boiler ready for commissioning at the Margam works of the Steel Co. of Wales



3. General view of Little Barford "B" turbine house. Automatic control of boilers from special and normal unit control rooms (the "block-house," left) is a feature



4. The turbine hall at the Kariba hydro-electric station, open to visitors

in the kitchen, six in each living-room, five in double bedrooms and three in single bedrooms.

One other major topic—apart from the perennial one of wages—occupied the installation section of the industry during the year. It was the question of the colour coding of flexibles, especially the flexibles on imported electrical domestic appliances. After much discussion, agreement was reached in an international committee, to have a green and yellow stripe recognised as an alternative to all national standards for the earth core colour.

Although the installation side of the industry may not have given rise to many headlines during the year, it was fully occupied with building activity. The retail side, however, caught the full effect of the hire-purchase and other credit restrictions imposed by the Government, and towards the end of the year official statistics began to show clearly how severely trade had fallen off in many appliances.

Throughout the year there was news of the long-envisaged electrical testing organisation, and effective operation of this, as the British Electrical Approvals Board, was announced in October, with a promise that publicity for the scheme would begin in the early months of 1961.

Another factor in the trading scene—and in manufacturing—was once again the effect of the Restrictive Trading Practices Act. The industry's orderly trading structure, centred on the Electrical Fair Trading Policy, dies formally on the last day of the year, but the secession of trade associations during the year showed the way things were going. Amongst individual associations affected was ELFA, which in March abandoned its trading codes. Cable price increases in February had brought a reminder of the bad effects of the RTP Act in 1959. They were brought about by establishment of strong price leadership and, of course, amalgamation and take-over of some cable firms.

A trend in organisation in the wholesaling sector of the trade was stressed in March at the annual dinner of the EWF, where a suggestion by the president that electrical wholesalers should become more specialised in terms of what they stocked, attracted much attention.

Manufacturing

Much of the activity of electrical manufacturers is reflected in the events already surveyed in this article. They showed in their willingness to tackle advanced technical projects the usual enterprise which has marked the electrical industry. However, the high cost of research necessary to such endeavour was much in the news during the year and showed itself notably in an April agreement between AEI, Reyrolle and Parsons to pool research facilities and results.

Lower raw material prices were a help to manufacturers during the year, although likely to become a hindrance in terms of this export effort. For all the year this subject of export was a thorny one for the industry, for previous performances proved hard to maintain. Export exhortation from official quarters was not lacking and formed one of the main features of the Budget speech.

Two specialist achievements of British manufacturers are particularly worth recording. One was the equipping of the futuristic S.S. *Canberra*, launched in March, and having some 6 MW of auxiliaries electrical generating plant, apart from main turbo-electric propulsion. The ship was notable for having a 60 c/s system for its auxiliaries supply in place of the usual marine d.c. system. Second of these notable advances was the equipping of the first heavily loaded main-line section of the 25 kV, 50 c/s rail electrification, from Manchester to Crewe. Despite recent troubles with electrification and continuous criticism of BTC finances, this represented a major manufacturing and design effort which attracted admiration abroad.

Round-up

These, then, are some of the major memories of 1960, taken from the earlier quarters of the year in the main, as the news since October is reasonably fresh in the memory. Much of miscellaneous interest has inevitably been left out. For example, the furore caused by publication by a Royal Commission of evidence showing engineers' salaries to be very poor compared with those of most other professional classes. There was, as well, the beginning of a sustained drive by presidents of the senior engineering institutions to put over the idea of the term "chartered engineer" for general use, without undue concern about the speciality involved.

A report on the metric system showed British industry cool about its compulsory adoption, but a Bill introduced into Parliament during the year made provision for tying the Imperial system firmly to the international metric standards.

And in wet 1960, Australian engineers recorded the first claim for infallibility in artificial rain-making!

Above, English Electric 3,000 h.p. locomotive for Manchester-Crewe 25 kV, 50 c/s electrification scheme

Left, The Bradwell reactors and heat exchangers, with turbine hall and administrative block, seen in October

OVERSEAS NEWS

from our correspondents abroad

CANADA

Crash Commissioning Avoids Cut

Emergency testing and commissioning of a newly constructed transmission line linking Manitoba to Boundary Dam generating station enabled the power crisis, threatened by icing of the Winnipeg River, reported in last week's issue, to be averted. The line, which was installed to meet such eventualities, was put in service while ice was cleared from the three hydro power stations' intakes.

Plastics Cable Ducting

Plastics pipes for underground cabling are being used by Etobicoke Hydro-electric Commission, of Ontario. In the past few months, 18 miles of plastics ducting have been installed. The system is claimed to reduce the cost of installation and give increased system flexibility.

JAMAICA

Transformer Contract

Orders for 80 transformers from 5 kVA to 100 kVA have recently been placed with South Wales Switchgear by the Jamaica Public Service Co. Two other orders placed with the company are for 350 MVA oil circuit-breaker and isolator equipment. The company have recently completed a switchboard incorporating 250 MVA, 12 kV oil circuit-breakers for Montego Bay.

TRINIDAD & TOBAGO

Electricity Loan Negotiations

Negotiations between the Trinidad Government and the World Bank are continuing for a loan of WI $42 million to improve and expand electricity facilities in Trinidad. A prerequisite to the loan is the formation of a single administration for the various electricity authorities.

The annual report for the Trinidad and Tobago Electricity Commission for the year ended 31 Dec., 1959, records a substantial increase in generation by 18·7% to 221·4 million units. Sales rose by 20·5% to 189·4 million units and the maximum demand on the system rose to 41·2 MW. Early in the year, work began on the second 20 MW extension at Penal Station, but at the Port of Spain station, diesel sets had to be derated because of age.

GERMANY

Nuclear Contract Awarded

A group of power companies in south west Germany has awarded a contract for a nuclear power station to North American Aviation. The reactor will be organically moderated and is to have an electrical output of 150 MW. Study of the project is to be completed in little more than a year and it is hoped that the station will be in operation by the end of 1965.

EGYPT

More Aswan Power

Soviet experts say the capacity of the hydro-electric station at Aswan on the River Nile can be increased by 300 MW to 2,400 MW. It is now proposed to install 14 turbines instead of the 12 originally planned. Soviet Union is also being asked to supply 40% instead of the original 25% of preparatory equipment for the irrigation schemes.

PAKISTAN

GEC in Motor Agreement

Motors up to 25 h.p., sufficient to meet the needs of East Pakistan and 50% of West Pakistan's requirements as well, are to be manufactured jointly by GEC and Elshee Bakhsh according to reports from Chittagong. GEC will provide technical know-how and the Pakistan firm are providing Rs 25 lakh capital. GEC are reported to be taking negligible royalties and will be training technicians in Britain. Annual motor production is scheduled at 5,000 and transformers and switchgear will also be manufactured under the agreement.

INDIA

Kundah Commissioning

The Canadian Prime Minister, Mr Diefenbaker, has been invited to commission the second Kundah hydro-electric power house on 18 Jan., 1961. The two Kundah stations and the Geddai station total 180 MW and represent an additional 50% of power for the Madras system. The station was constructed with Canadian aid worth Rs 1.250 lakhs.

AUSTRALIA

Nuclear Not Economical

At a recent lecture given in Sydney, Sir William Hudson, Commissioner of the Snowy Mountains Hydro-electric Authority, said that nuclear generation could not compete with thermal or hydro-electric schemes in Australia for many years to come. However, when nuclear generation became economical it would provide an ideal base load source to work in conjunction with hydro-electric peak load stations.

Power for Smelter

Answering questions about the sale of Bell Bay aluminium facilities to overseas investors, the Minister of National Development said Tasmania would have been unable to develop its aluminium resources without overseas capital. He also said that the use of power from the Snowy Mountains scheme for an aluminium smelter was impracticable.

Poatina Pipe Line Contracts

Two major contracts for high pressure pipe lines for the Poatina 400,000 h.p. hydro-electric underground power station have been placed. Contracts for the upper section, valued at more than £800,000, have been placed with Humes Ltd., of Hobart. The high pressure pipe lines will be supplied by Acciarieria e Tubificio Di Brescia, of Italy. This pipe line, which will be 8 ft 9 in. dia, has to sustain a water pressure of 1,300 lb/sq in. The pipe will be reinforced with forged, high-tensile steel bands. The Poatina station is scheduled for commissioning in 1964.

Sydney Surplus Estimate

Sydney County Council expect a surplus of £114,000 next year without increasing present charges for power. Revenue at an estimated £34·9 million is based on a 9·7% increase in anticipated sales of electricity. Although the bulk supply obtained from the Electricity Commission had been reduced in price by 1½%, the Council do not consider the surplus will be sufficient to justify reduction in charges. Expenditure in the next year is estimated at £34·75 million and includes £900,000 for land and buildings and £267,000 for sub-stations. An allowance of £2½ million has been made for mains construction.

Personalities *in the industry*

Chief engineer of the Midlands Electricity Board since 1957, **Mr G. S. Buckingham,** B.SC.(ENG.), M.I.E.E., has also been appointed to be a member of that Board with effect from 1 Jan. next, while continuing to serve as a full-time member of the Board. It is also announced that **Councillor H. T. Fullwood** retires from part-time membership of the Board on 31 Dec. (*ESH, page 121). A native of Glasgow, Mr Buckingham was educated at Norwich school and at Faraday Hse Electrical Engineering College, where he won the Faraday Hse diploma and gold medal. From 1924 to 1926 he was with the Yorkshire Electric Power Co. at Leeds in the mains department and as personal assistant to Mr W. B. Woodhouse. He then joined the staff of Pirelli-General Cable Works Ltd., first as senior contracts engineer and later as district engineer and branch manager for the Midlands, based in Birmingham. When the supply industry was nationalised in 1948 he was appointed chief purchasing officer of the MEB, a post he held until succeeding Mr G. F. Peirson in 1957.

Sir John Wrightson has accepted an invitation to join the board of A. Reyrolle and Co. Sir John is chairman and managing director of Head, Wrightson and Co. Ltd.

Mr G. M. S. Leader has resigned as a director of Hailwood Industries and **Mr J. H. Scott** has been appointed a director.

Retiring from the position of district manager for Lorne and the Isles, for the North of Scotland Hydro Electric Board, **Mr M. J. Keane,** A.M.I.E.E., was recently the recipient of gifts from colleagues and friends at a gathering at Oban (*ESH, page 174). Mr Keane had operated from Oban since 1948 when he was transferred from Skye and Lochalsh.

Formerly with Metropolitan-Vickers, **Mr J. K. Brown** has joined the British Transport Commission as principal scientific officer at the Electric Traction Research Station.

The Minister of Power has reappointed **Mr A. N. Irens,** J.P., M.I.E.E., as chairman of the South Western Electricity Board for a further period of five years from 1 March, 1961. Mr Irens originally became chairman of that Board in 1956 after being a part-time member of the Board from its formation in 1948. Earlier he was chief electrical engineer to the Bristol Aeroplane Co. Ltd. in addition to operating a consulting practice under his own name.

Mr C. R. Wheeler, chairman of Guest, Keen Iron and Steel Co. and additional vice-chairman of Associated Electrical Industries Ltd. takes up duties as president of the British Iron and Steel Federation on 1 Jan.

Mr J. Douglass Latta, M.C., has been appointed a director and chairman of Glenfield and Kennedy Ltd. and **Mr W. B. Trenholme,** general works manager at Kilmarnock, also becomes a director as from 1 Jan.

Deputy manager of the Accessories Division of British Insulated Callender's Cables Ltd. since April last, **Mr E. F. Duncan,** A.M.I.E.E., has been promoted to manager of that Division as from 1 Jan. next. Mr Duncan was educated at Strathallan School and Glasgow University and, after a period of commissioned service in the Royal Signals, trained as a contractor with James Kilpatrick and Sons Ltd., Paisley, joining BICC at the end of 1952. He served with the Wiring Development Department for three years as an advisory engineer on special installations and then transferred to the Scottish Region as sales engineer for power cable systems and accessories before joining the Accessories Division at Prescot in 1957 as assistant to the sales manager. He was appointed divisional sales manager of the Accessories Division in 1959, deputy divisional manager in April, 1960, and is a director of BICC-Burndy Ltd.

Previously general sales manager of the company, **Mr A. W. Page,** M.B.E., has been appointed sales director of Brookhirst Igranic. Born at Hove in 1914, Mr Page was educated at Hove High School and Brighton Technical College. He joined the old Igranic Electric Co. at Bedford in 1934, and was made general sales manager when the company was merged with Brookhirst Switchgear in 1959. During the war he served with the RE's retiring as Lieutenant Colonel.

Mr W. F. Brooks will be relinquishing his position as secretary of the British Electric Traction Co. to take up an executive appointment with Rediffusion Ltd. He will be appointed to the boards of a number of companies in the Rediffusion Group. **Mr Neville Smith,** secretary of Rediffusion, has been appointed secretary of the British Electric Traction Co. and **Mr D. A. Smith,** chief assistant in the BET Secretariat, will succeed Mr Neville Smith as secretary of Rediffusion. These appointments will date from 1 Feb.

Mr W. Latta has been appointed director and general manager of Rhodes, Brydon and Youatt Ltd. following the acquisition of that company by Crane Ltd.

Formerly technical sales representative, **Mr B. J. Blackmore** has been appointed Order Department manager of the British Central Electrical Co. Ltd.

Mr D. Watson is now in charge of the Stockton-on-Tees district office of Evershed and Vignoles Ltd.

First award of the Royal Society's Gold Medal has been made to **Sir Cyril Hinshelwood,** O.M., F.R.S., who retired as president on 30 Nov. last. The award has been made in recognition of his outstanding contributions to physical chemistry.

Mr H. Smith, executive vice-president and director of International Power and Engineering Consultants Ltd., and Mr **F. Woollaston,** consultant with that firm, have been elected Fellows of the American Institute of Electrical Engineers. They receive their awards for the part they played in construction and design of the continent's highest voltage transmission line and the world's longest extra high voltage submarine cable, both located in British Columbia. Mr Smith, formerly chief engineer with BC Electric

Mr G. S. Buckingham

Mr A. N. Irens

Mr E. F. Duncan

Mr A. W. Page

** Denotes revision to the "Electricity Supply Handbook, 1960."*

and subsequently general manager of BC Engineering, had major responsibility for planning the submarine cable across the Strait of Georgia to Vancouver Island. Mr Wollaston, a native of Victoria, has achieved international recognition as an authority on extra high voltage transmission and was directly responsible for the engineering design and development of BC Electric's pioneer extra high voltage lines.

Sir Arthur Elton, of Associated Electrical Industries Ltd., is a member of the Working Party set up by the Department of Scientific and Industrial Research under the chairmanship of **Dr W. L. Francis,** which is to consider national needs in the field of scientific film.

Sir Stanley Rawson has joined the board of Harper Engineering and Electronics as chairman. **Mr N. C. Weaver** has relinquished this post but has remained on the board. **Mr H. W. Bishop** has also joined the board.

The chairman and members of the Eire Electricity Supply Board recently gave a dinner to mark the impending retirement of **Mr P. J. Dempsey,** secretary of the Board since its establishment in 1927, and **Mr J. MacDonald,** chief civil engineer. Mr MacDonald entered the Board's service in 1930 on completion of the Shannon power station on which he had been engaged.

On the retirement on 1 Jan., 1961, of **Mr A. Friswell,** general manager of the Steam Turbine Division of the English Electric Co. Ltd., **Mr L. J. Garibaldi** will become manager of the Steam and Gas Turbine Divisions, Rugby. Mr Garibaldi who has been contracts manager, Steam Turbine Division at Rugby since 1955, will be responsible to the general manager, Rugby and Whetstone for all the commercial activities connected with turbines and for the co-ordination of enginering sales and contracts.

OBITUARY

Mr Tooh Vajrathan, deputy manager of the Metropolitan Electricity Authority, Bangkok, died recently near Chichester, aged 50. He was in this country investigating the possibility of purchasing electrical equipment for Bangkok's first trolley-bus service. At an inquest it was stated that he was found dead at the bottom of a steep staircase at a house where he was staying. A wall switch had the cover removed and it was suggested that he might have received a shock from the bare terminals, which could have caused him to lose his balance.

Mr W. R. B. Wood, ASSOCIATE I.E.E., formerly manager of the Southgate/Wood Green district of the Eastern Electricity Board, died on 13 Dec., aged 70. He started with the Northmet Power Co. in 1920 as an assistant engineer and, in 1926, became resident engineer for Chingford. In 1947 he was appointed district superintendent, Southgate, continuing in that capacity until the Southgate and Wood Green districts were merged in April, 1951, when he was nominated district manager. He retired in September, 1955.

Mr Louis Paul Haussauer, founder, chairman and managing director of Aidas Electric Ltd. died at his home at Ealing on 19 Dec., aged 65. Mr Haussauer was born in Geneva, came to Britain in 1916, and set up business as a manufacturing jeweller. In 1923 he began making electric water heaters, and in 1934 pioneered low-cost electric water heating in this country with the introduction of the "Sadia" 1½gal heater designed to fit over the kitchen sink. Mr Haussauer was a former captain of Sudbury Golf Club and leaves a widow, two daughters and two sons who are directors of the company.

Mr A. C. Goodall, manager of the Remploy Sales Division marketing tubular sheathed electric elements, died on 14 Dec.

Sir Godfrey Ince, chairman of Cable and Wireless Ltd. and former Permanent Secretary of the Ministry of Labour, died on 20 Dec., aged 69.

BRITISH STANDARDS

Tubular Fluorescent Lamps for General Lighting Service. *BS 1853:1960. Price 7s 6d.* This is a revision of the 1956 edition, the main differences being the inclusion of a clause in section 4 laying down the conventional arrangement of connections to the lamp cap, the extension of Appendix E to cover switchless start circuit lamp tests, some minor changes in writing style and the extension of the references to b.c. and bi-pin capped 80 W and 125 W lamps. The Macadam ellipse chart has also been dropped. An obvious misprint occurs in the table on page 21 under the heading "rated watts" where the first item should read 20 and not 80.

Domestic Electrical Clothes Washing Machines. *BS 3287:1960. Price 6s.* Following the usual layout of its type, this standard deals with the appliances under two headings: earthed and machines with double insulation. Section 2 includes a table on minimum creepage distances, clearances, distances through insulation and clauses on wringers, centrifugal extractors and water heaters. Safety clauses include the maximum gap on opening lids to centrifugal extractors before switching off, the period before the drum comes to rest and maximum leakage currents between case and live parts on earthed and double insulated machines. Testing requirements include an extensive range of temperature runs on washing cycles with the machine loaded to manufacturers' recommendations. No provision is made for standards of performance.

Domestic Electric Irons. *BS 1732: Part 1:1960. Price 5s.* A revision of the 1951 standard, this is now divided into two parts: ordinary and steam irons. Part 1 is confined to ordinary irons. The standard differs little from the earlier issue apart from a rearrangement of the contents and separation of the requirements from the test methods by which they are measured. A significant change is the reduction of handle temperature from 130°F to 90°F. Part 2 is yet to be issued.

Insulator and Conductor Fittings. *BS 3288: Part 1:1960 Price 5s.* A new standard for overhead line accessories, this now supersedes the addendum to BS 137 published in 1955. The standard is in two parts; the first defining terms used and the second dealing with dimensional standardisation. The present specification is in seven sections, of which the first is the usual general one listing definitions, etc. The subsequent sections deal with insulator pins, insulator set fittings and earth conductor fittings, tension joints and anchor clamps, non-tension joints, suspension clamps, electrical control fittings and mechanical protective fittings. Part 2 is in course of preparation.

Measurement of voltage with sphere gaps. *BS 358:1960. Price 6s.* This is the second revision of the original standard which appeared in 1929, the first revision following in 1939. The main reason for the present issue is to keep it in line with the IEC recommendations which appear in IEC publication 52. A method of checking spheres for surface irregularities is also included and information on irradiation of sphere-gaps is given in detail. There are a number of differences, mostly small, between the values for breakdown given in the 1939 and present revision and the line diagrams which were a feature of the older issue have been omitted.

Sampling Superheated Steam from Steam Generating Units. *BS 3285:1960. Price 7s 6d.* A new specification, complementary to Addendum 1 of BS 2690 on the analysis of high purity water, this lays down methods and equipment for sampling superheated steam, for the determination of purity, from high pressure boilers such as are used in generating stations. It will be of interest and value to station engineers but to few others in the industry.

Copies of the above standards may be obtained from the British Standards Institution, Sales Branch, 2 Park St, London W.1.

Transformers in court

FINAL SPEECHES AS CASE NEARS END

FINAL stages in the Restrictive Practices Court hearing on the Transformer Manufacturers' Association case were completed last week. Hearings were occupied by speeches from counsel for the Association and for the Registrar of Restrictive Trading Agreements.

For the Registrar, it was said that so far as very small transformers were concerned, most members of the Association were not able to compete on price with the smaller, independent manufacturers who specialised in making a limited number of smaller-rated transformers. This meant, if it was correct, that Association members were not in general such efficient manufacturers of the smaller type of transformer as were the smaller independent makers.

Despite this, the Association had given a collective rebate to all area boards who purchased small transformers from members. It was use of this collective weapon that had caused the present low prices in small transformers. Association members had, in fact, tried to win business for which they could not properly compete. They had failed to reorganise their factories suitably.

In the view of the Registrar, Association members ought to concentrate on the manufacture of large transformers, for which they were suitably equipped.

Counsel noted that the Association had claimed that the profits of its members were not unreasonably high, but the only profits relevant to the case were those made on large transformers, in which the Association had a monopoly. Profits on large transformers seemed high; the difficulty in judging profits was that it was impossible to find out what was the percentage of profit in relation to capital employed.

There was no satisfactory common system of costing used by Association members. This meant that although prices were generally based on the average of the three lowest-cost producers, there were cases of "extreme variation" in costs, even between the lowest and the second lowest. Counsel argued that it was quite plain that there was no guarantee that prices arrived at were fair or reasonable.

The case so far . . .

The ten-member Transformer Manufacturers' Association has defended before the Restrictive Practices Court its agreement providing minimum prices for transformers sold for use in the UK. Witnesses for the Association have drawn attention to under-employment of the capacity of the industry at present and have underlined its difficulties in selling overseas. They have also described tentative negotiations by individual members with non-member firms in an attempt to extend Association membership and have said that without the agreement, home prices would fall. Supply industry representatives and non-association manufacturers have given evidence for the Registrar of Restrictive Trading Agreements. The case began on Monday, 21 November.

There was some discussion with the presiding judge about where the report of the Monopolies Commission on heavy electrical manufacturing was relevant; and also whether statements made by Lord Citrine and Sir Josiah Eccles could be considered. Mr Justice Russell said he did not think that these statements were relevant "particularly since Lord Citrine thought that the Restrictive Trade Practices Act was harmful."

Price War Risks

Turning to the suggestion that the abandonment of the agreement would lead to a price war, counsel argued it was illogical to suppose that manufacturers would engage in violent price-cutting when they knew the results would be harmful to the industry. Even if there were a price war, it did not follow that there would be any sacrifice in quality or cut in research and development expenditure. He added that if a price war showed signs of starting, it was probable that two or three of the larger manufacturers would stand aside.

On the whole, evidence before the Court, counsel claimed, had shown that electricity supply orders were put out to tender. When a tender was put in by a manufacturer, the evidence had shown that there was no question of price negotiation or of "fiddling" by the supply authority. It was wrong to suggest that there was evidence of any combination between electricity boards to control prices of transformers. Moreover, so far as large transformers were concerned, the CEGB were not a preponderant buyer when the export market was taken into account.

Dealing with the suggestion that loss of the agreement would lead to a reduction in exports, counsel noted that evidence was that export prices were rising and were likely to continue to do so. Moreover, it was clear that level tendering was intensely disliked by some overseas buyers.

Association Case

In his reply, counsel for the Association argued that the CEGB had the power to force prices unreasonably low; whether it exercised it or not was irrelevant to the case.

He said that the industry's capacity for the largest transformers greatly exceeded requirements in the UK, and export prices were well below a reasonable level. In such circumstances, if the agreement were ended, home prices would be likely to fall towards export levels.

Dealing with the suggestion that the Association had been reducing prices to unreasonably low levels for the purpose of gaining trade from non-member manufacturers, he said that there was evidence of only one price reduction by Association members and that was when a collective rebate, which had been removed in March, 1958, had been restored in January, 1959. Association members had lost a lot of their established trade in smaller transformers when they had tried to increase prices in 1958.

T.I. house— all-electric headquarters

OFF-PEAK FLOOR-WARMING INSTALLED

THE adoption of off-peak floor-warming for TI House, recently constructed Birmingham headquarters of Tube Investments Ltd., provides further evidence of the growing recognition of the merits of this type of space heating. It completes the all-electric services for the building, for which the greater part of the equipment and material was supplied by companies of the Electrical Division of TI. The building, seven storeys high, is neo-Georgian in architectural style, with a reinforced concrete frame supporting 14 in. brick walls and 10 in. thick concrete floors. This solid construction makes for low heat losses and high thermal storage capacity, and is thus well suited to the heating system chosen.

Heating Cables

The design of the heating scheme is based on the maintenance of a nominal temperature of 65°F, and to this end the Simplex system of heating cables is installed throughout the building. The electrical loading density is graded to suit the varying heat losses and thermal capacity of different parts of the building; it ranges, in fact, from 10 W/sq ft up to 17 W/sq ft. In addition to those under the floors, elements are also buried in staircase walls and, for de-icing purposes, in the concrete ramp leading to the basement car park.

On main floor spaces the cable heating elements are laid out at the appropriate spacing in 20 ft by 6 ft 9 in. bays and covered with concrete screed. The "cold leads" of the elements are connected to heating supply sub-circuit cables which run round the inside of all external walls, housed in the horizontal portion of special "L" section floor/skirting trunking. The floor portion of the trunking has a well-type cover which can be filled-in flush with the level of the final floor-covering material. On stairs and landings, an expanded metal mat is buried in the screed covering the heating cables, this being for both protection and plaster reinforcement.

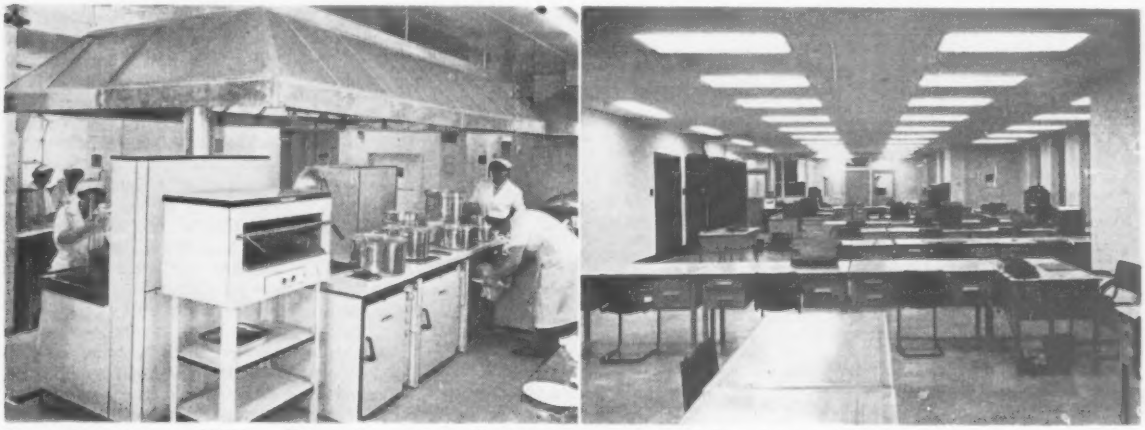
Temperature Control

Temperature control on the main floors is maintained by internal thermostats wired to each heating bay overridden by two anticipatory thermo-time control elements mounted on the roof of the building. Thus, the time during which the heating elements are switched on during the off-peak period is governed by both the residual heat in the building and external climatic conditions. Because the first three floors are sound-proofed and have double-glazed windows, air-conditioning is installed in this part of the building, and is regulated in conjunction with the floor-warming during winter months. Off-peak time and cascade master control switches are housed in the basement.

Turning to the main distribution system of the building, the backbone of this is formed by three busbar trunking rising mains. Each of these has 500 A busbars for supplying power and lighting sub-circuits, two having in addition 750 A bars serving the under-floor heating. The rising mains are in turn fed from the main switch-room in the basement, by means of cambric-insulated, lead-sheathed cables. Incorporated in the rising mains' trunking, at island positions on each floor, are cubicle-type switchboard units. These house flush-mounted h.r.c. fused switches and distribution boards for underfloor heating protection, and m.c.b. boards for power and lighting.

Service Cabling

From the floor switchboard positions, underfloor cable trunking runs interconnect lighting points for ceilings beneath and also feed the floor/skirting trunking mentioned previously. The vertical skirting portion of the trunking is partitioned off to house power and telephone cables, and has adequate provision for telephone and 13 A power outlets at regular intervals. In all, 47 miles of cables were used; cambric-insulated, lead-sheathed for mains and p.v.c. insulated for distribution.



Electrical installation at TI House, Birmingham, includes Simplex kitchen equipment, left, and recessed Panellite lighting fittings shown here illuminating department offices on the 4th floor

Kitchen Equipment and Lighting

One of the showpieces of TI House is the all-electric kitchen, situated on the top floor of the building. It is equipped to serve both main meals and light snacks to the main dining-room on the same floor and the directors' dining-room below. The main equipment comprises Simplex heavy-duty ranges, a steaming oven, grillers and fish fryers. The call order unit for preparing light meals has a ventilating canopy which is removeable for washing off accumulated grease. Equipment, which includes normal kitchen machinery, is supplied from a switchboard mounted on one of the rising main busbar trunks, controlled by a 300 A t.p. and n. fuse switch.

Notable features of the lighting installation of the building is the use of specially designed recessed-type fittings for suspended ceilings on the third, fourth and fifth floors. These are of aluminium construction with hinged Perspex diffusers in three standard lengths and accommodating single or multiple fluorescent tubes. In the kitchen, lighting is provided by special p.v.c. covered, anti-corrosive fluorescent fittings.

The electrical system for the building was designed and installed by Power Centre Ltd., who also supplied the busbar trunking. The floor-warming scheme was prepared by Simplex Electric Co. Ltd, cable heating elements and all other cables being supplied by Mersey Cable Works Ltd, and all lighting fittings by Simplex. Electrical consultants were Messrs. Couzens and Akers Ltd., and main architects Messrs. Cotton, Ballard and Blow.

NEW LITERATURE

Electricity Undertakings of the World, 1960-61

WITHIN its strong binding, this 70th edition provides many details of electricity supply authorities in Britain, the Commonwealth, and in other countries throughout the world on the same basis as former volumes. Each year brings a few additions in the latter category, for the aim is to make the volume as complete as possible. But for countries behind the Iron Curtain, the technical data is meagre, as might be expected. That apart, it provides a good deal of up-to-date information concerning other countries which makes the volume good value. Published by Benn Brothers Ltd. 648 pages, 8¼ in. by 5¾ in. Price 35s 6d.

Electronic Circuits, Signals and Systems

by S. J. Mason and H. J. Zimmermann

ONE of the major problems in technical education today is to keep literature up to date with the continuous spate of discovery and development in the scientific industries. Textbooks of even ten years ago seem hopelessly inadequate with no mention of semiconductors, yet these devices were practically unknown in 1950. So it is with other aspects of a fast-moving world technology.

In the early 1950's the Department of Electrical Engineering at the Massachusetts Institute of Technology, USA, laid down a programme, or "core curriculum," designed to keep student technology abreast of progress in science and industry. As part of the programme they commissioned a number of textbooks on specialist subjects from professors on their staff who were actively concerned with the subjects and were abreast of the latest ideas, theories and discoveries. The first appeared in 1953, a book on Introductory Circuit Theory, and in 1959, Mason and Zimmerman published their first joint work in the programme, "Electronic Circuit Theory," which they have now followed by a companion work.

The latest book deals with methods for more general circuits than those in the earlier volume, includes a study of matrix-circuit analysis, flow-graph theory, signal analysis, Fourier series, transmission through linear and non-linear systems and concludes with a chapter on negative feedback concepts. As with the earlier work, the contents are highly condensed, well saturated with mathematics and will be stiff going for even the advanced student. The preface, however, suggests a number of ways in which the material can be organised for classroom presentation. Published by Chapman and Hall, 612 pages, 9 in. by 5¾ in. Price 100s.

Electromagnetic Fields, Energy and Forces

by R. M. Fano, Lan Jen Chu and R. B. Adler

THIS is another book in the M.I.T. "core curriculum" series. The introduction claims that it has been developed for use by junior students in electrical engineering, but the contents are almost entirely confined to mathematical and philosophical discussion on electro-magnetic theories. One may wonder whether this is not too specialist an approach for the student who, unless he is intending to take up academic pursuits, will find it of limited value in the more practical fields of applied technology. Beginning with a statement of Maxwell's equations and proceeding via Lorentz, Poynting, Laplace, to a final chapter on the Einstein concept of the four-dimensional formulation of electrodynamics, it is, no doubt, a masterly and well presented treatise on electromagnetic theories. But nine-tenths of the practical work of applied electricity and electronics today is being carried out by engineers to whom these theories are but a distant and part forgotten memory of their own student days. The presentation is, as always in this series, excellent. Published by Chapman and Hall, 513 pages, 9 in. by 5¾ in. Price 96s.

BOOKS RECEIVED

World Railways 1960. Sixth and revised edition covering more comprehensively than previous editions leading statistics of the world's railway systems. Modernisation receives more attention and the section on underground systems is enlarged. Published by Sampson Low's "World Railways" Ltd., 412 pages. 12¼ in. by 8¼ in. Price £5 5s.

Engineering Management, by S. A. Robertson. Study based on lectures to those preparing for I.Mech.E. examination in industrial administration. Published by Blackie and Son Ltd., 467 pages, 8¼ in. by 5¼ in. Second edition, price 30s.

The Modern Slide Rule, by R. Stender and K. K. McKelvey. Self-instruction manual dealing with computational techniques. Published by Cleaver Hume Press, 119 pages, 8¼ in. by 5¼ in. Price 6s.

La Modulation de Frequence, by J. Marcus. Theory of frequency changing and industrial applications. In French. Published by Editions Eyrolles, 61 Boulevard Saint Germain, Paris, 317 pages, 9¼ in. by 6 in.

Video Tape Recording, by J. Bernstein. Textbook on recording of television signals. Published by Chapman and Hall. 268 pages, 8¼ in. by 5¾ in. Price 72s.

The Dielectric Circuit, by P. Kemp. Basic principles of voltage distribution in steady state and transient conditions. Published by Chapman and Hall. 219 pages, 8¼ in. by 5¼ in. Price 45s.

Induction-Type Integrating Meters, by G. F. Shotter and G. F. Tagg. Surveys results of authors' investigations over 20 years and gives account of other researches. Published by Sir Isaac Pitman, 214 pages, 8¼ in. by 5¼ in. Price 63s.

Tectonic Printed Circuit Designers' Handbook. Initial guide to printed circuit design in terms of layout and art work. Published by Tectonic Industrial Printers Ltd., 17 pages, 7¼ in. by 4¼ in.

Dictionary of Electronics, by H. Carter. Illustrated dictionary of more common terms, including brief technical explanations. Published by George Newnes, 377 pages, 7¼ in. by 4¼ in. Price 35s.

Two Hundred Precious Metal Years, by R. E. Wilson. A history of the Sheffield Smelting Co. Ltd. over the period 1760 to 1960. Published by Ernest Benn Ltd., 316 pages, 9 in. by 5¼ in. Price 63s.

Rugby Engineering Society Proceedings, Vol. I, 1959-60. Includes papers on powder metallurgy, semiconductor materials, atomic energy factories and engineering aspects of newspaper printing. Published by Rugby Engineering Soc., 119 pages, 8¼ in. by 5¼ in.

Lighting fittings design

PRACTICAL CONSIDERATIONS AFFECTING PERFORMANCE

by J. Mellanby, M.A., A.M.I.E.E., M.I.E.S.

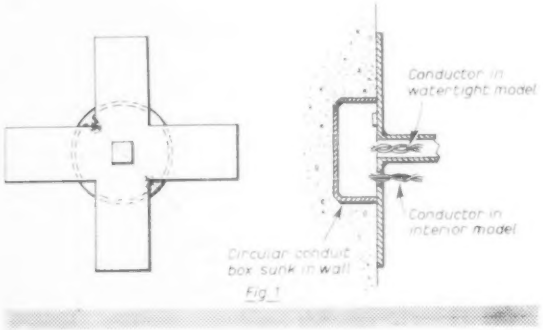
A LIGHTING fitting has three functions to perform:
(1) To support the light source (lamp or tube) in such a way that current may be safely led to its terminals.
(2) To control the light by reflection, refraction or diffusion so as to give the desired effect.
(3) To be of good appearance, both when illuminated and by daylight.

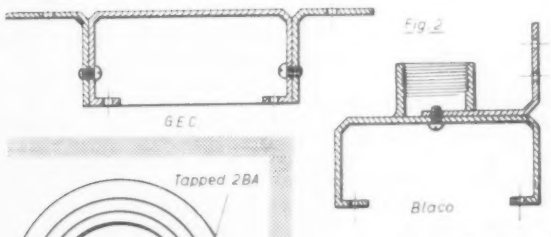
Successful design, therefore, requires co-operation between the electrical engineer, the illuminating engineer and the artist or architect. In this review, various features of lighting fittings design are examined, examples being taken from the conventional, "period" and the "contemporary" products of a number of manufacturers. Particular attention has been paid to the effects on design of the new, small envelope lamps running at higher temperatures and to the need for simplifying fixing and wiring arrangements in view of rising labour costs. We shall not be concerned with either illuminating efficiency or artistic merit, but rather with the engineer's part, which involves convenience in installation, safety in use and easy maintenance. Typical designs are illustrated. Some show how the different and sometimes conflicting factors have been harmoniously combined, while others appear to indicate that the engineer has been completely ignored and that IEE Regulation 207G remains an unknown quantity to the "artistic" gentry.

Electricians have had cause to grumble about inadequate wiring spaces ever since the time of the first converted gas fittings and the IEE Regulations still allow an extra small conductor (1/·036 or 3/·020) under the designation of "fittings wire" in such situations. Modern plastics-insulated cables, with their small overall diameters, should render this material quite unnecessary today. Very often, however, the weakest link in the whole installation is found where the fitting is connected to the building wiring. Thirty years ago, dry, taped joints were either put behind wood blocks or else squeezed into the bulge of ceiling plates, this practice being so common as to be considered almost normal, especially in domestic work. Although ceiling plates with holes at 2 in. centres for use with conduit boxes were made, the demand for them was so small that wholesalers did not usually carry stocks. They had to be ordered specially. Practically all fittings in those days had to be mounted on wood blocks, whatever system of wiring was employed, and a large range was generally available up to 6 in. diameter or over. Considerable extra labour was involved, however, when it became necessary to interpose such a block between a conduit box and the fitting, quite apart from the 2 BA countersunk screws and the provision of some means of earthing.

Before concluding this flashback to an earlier period, we are reminded of an installation in a half-timbered Tudor mansion which we carried out in 1930, as it brings up a number of points which are still relevant today. The client made two stipulations; the installation was to consist of a completely concealed screwed conduit system, with all fittings, switches and socket-outlets mounted on iron boxes so as to eliminate, as far as possible, fire risk inherent in such a property, and the lighting fittings were to be of wrought iron in keeping with the character of the building. Actually, the last were made by a small family firm in the vicinity. The ancestors of the then proprietor must have turned out many such candelabra and brackets for use with real wax candles, rather than electric imitations, in the intervals between the main job of shoeing horses.

The twentieth-century "standard" design included a wall or ceiling plate about 1½ in. square, only suitable for screwing directly to the wall or mounting on a wood block, but, after he had been shown a BS 31 box for, apparently, the first time in his life, he immediately provided larger backplates with the correct fixing holes. As the metal which supported the lampholders was solid and not hollow, there was quite considerable discussion about a suitable conductor which would be safe and yet inconspicuous. Since this was long before the days of plastics-insulated cables, "workshop flex," fixed by narrow strips of black tape, both of which were the same colour as the wrought iron, was finally agreed upon. Bracket lanterns available in 1960 suffer from the same defect (Fig. 1).





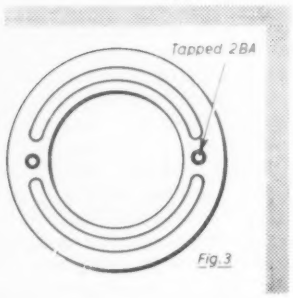


Fig. 1. Mounting of period bracket lamp on sunk conduit box

Fig. 2. Types of BS 31 ceiling boxes

Fig. 3. Adaptor ring for circular boxes

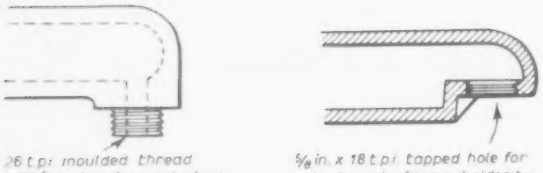

26 t.p.i. moulded thread with ⅛ in. hole for conductors
(a)
⅝ in. x 18 t.p.i. tapped hole for attachment of lamp-holder by brass nipple
(b)

Fig. 4. Types of moulded bracket arm ends showing limited cable exits. The design in (b) is easier to wire

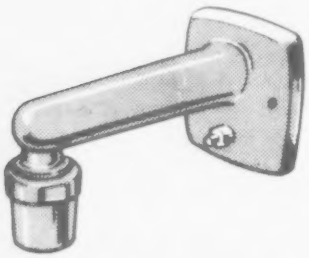


Fig. 5. Bracket fitting for base fixing to BS 1299 box

Suspending Ceiling Fittings

The small BS 31 box is still the standard fitting for ceiling points, for which duty it is ideal, and it is difficult to see how it could be improved upon. Used in conjunction with heavy gauge screwed conduit, no extra fixing is normally required to enable these boxes to support quite heavy pendants, but easily fixed brackets are available where extra rigidity is needed (Fig. 2). The only reference to the weights of fittings in the IEE Rules refers to the loads which may be carried by flexible cords (Table 27), though a manufacturer quotes the following maximum weights which can be safely suspended from various conduit boxes.

BS 31. Small Circular Box. 2—2 BA screws:
Steel Box 100 lb
Malleable Iron Box 200 lb

Large Circular Box. 4—0 BA screws:
Malleable Iron Box 400 lb

These figures were arrived at by experiment and were largely determined by the strength and rigidity of the lugs.

Since these loads are quite large, and imply that an electrician might safely support himself from the fixing commonly used for a ceiling rose, it seemed that some investigation into the strength of BA screws was called for. None of the data in an engineers' pocket book seemed to be directly applicable, so the following table was worked out from first principles:

Mild steel—yield point 36,300 lb/in.²
Brass—yield point 27,000 lb/in.²

Screw	Area at bottom of thread sq mm	sq in.	Load at 50% of yield point Mild steel	Brass
4 BA	6·20	0·00965	175 lb	130 lb
2 BA	10·93	0·0170	310 lb	230 lb
0 BA	18·10	0·0281	510 lb	380 lb

This seems to show an enormous factor of safety but it must be remembered that, when dealing with small screws, should any of these be a loose fit, the thread may be stripped long before an actual break would occur. A considerable stress may also be set up during the action of tightening—after all it does not take a very strong man to wring off a 2 BA screw—and any such stress must be added to the weight supported. However, if the box loadings given above are adhered to, the standard screws, whether cut or rolled thread, should be able to support them with an adequate margin.

The BS 1299 Box

Excellent as the round boxes are for ceiling positions, they are much less convenient when used for wall brackets. When used in a vertical conduit run, the lugs will usually be in the standard "twenty past" and "ten to" positions, though sometimes these positions will be departed from or even reversed. Moreover, objection may be made to the "assymmetry" of screw heads at 45° on a line across the base of a decorative fitting. At least one manufacturer lists an adaptor ring, with which fixings at any desired angle may be obtained, irrespective of the mounting of the box (Fig. 3). A more recent development involves the use of the square BS 1299 box originally designed for switches and socket-outlets, with 2—4 BA fixing screws placed horizontally or vertically at centres of 2⅛ in. Since this has proved to be so convenient for wall brackets and can be called a move in the right direction, it has also been suggested that it be used in ceiling positions as well. But here the advantages are more problematical. The need to set the boxes with their sides parallel to the walls of the room means more work for the wireman, especially if used in the multi-back-outlet looping form. (If any reader doubts this, let him try it for himself.) If circular ceiling plates are required, they must be at least 4⅛ in. diameter, as against 3⅛ in. for the BS 31 circular box, and the 4 BA screws have only about half the strength of 2 BA, even though, in the majority of cases, they should be more than adequate.

Plastics Brackets

Moulded bracket fittings are becoming increasingly popular and some very pleasant designs are now available in a variety of colours, together with suitably styled lampholders to match. It is a pity that these sometimes suffer from the old, old complaint of inadequate wiring space. It should always be possible to pass four 3/·029 p.v.c. cables to eliminate a joint behind the fitting and to allow for looping, but the example shown (Fig. 4a) had to be drilled out before even two such conductors would pass through without a struggle. Surely the makers do not expect present-day contractors to have to revert to "fittings wire"! Fig. 5 shows a bracket with an overlapping base for direct fixing to a BS 1299 box which requires no block or break-ring in flush work. The angle batten holder can be a most useful fitting in cupboards, narrow passages and other situations but the plastics version is, apparently, only made with fixing holes at 2 in. centres, placed horizontally. It can, therefore, only be fitted to a circular box if an adaptor-ring (Fig. 3) is interposed. Perhaps some enterprising manufacturer will produce one with a square base similar to that of the bracket mentioned above.

Continental Designs

Lighting fittings of continental design are becoming very popular in Britain and considerable numbers are being imported. However pleasant their appearance may be, they are bringing a fresh crop of fixing problems and a forcible reminder of the unresolved differences between British and European standards. There is a continental box, not very different from our BS 1299, intended for switches and socket-outlets, but the fixing screws for these accessories are at 38 mm (1½ in.) centres, instead of our 2⅛ in. centres, and some lighting fittings are made to fit this. However, when it comes to non-standard fixings, the Europeans have nothing to learn from us. The range of one German manufacturer includes porcelain-based ceiling

and bracket fittings in different sizes and with the following fixing centres:

Horizontal—1¾ in., 2¼ in., 2¾ in., 3¼ in.
Horizontal and vertical—2¼ in. by 2¼ in.

The British agent does not offer to supply wood blocks.

A metal backplate for glassware, this time of French origin, incorporates 38 mm fixing with provision for rotation and also an adjustable two-hole device which can be set anywhere from 2⅜ in. to 3½ in. Had this maker really had the British market in mind, he could easily have made the adjustment include the 2 in. for BS 31. A German maker of light alloy fittings for outside use has gone one better and provides a cast backplate which can be interposed between a circular BS 31 box and the base of his bracket, drilled with two holes at 2½ in. centres, placed horizontally.

External Fittings

In general, the mounting arrangements for outside fittings leaves much to be desired, particularly when used with concealed conduit. They certainly compare unfavourably with the surface-mounted industrial patterns. Two common faults are lack of earthing facilities and no way of preventing the entry of water to the wiring, especially when wall-mounted. While the "period" bracket already mentioned (Fig. 1) is a particularly bad offender in this respect, the "contemporary" design shown in Fig. 6 is almost equally unsatisfactory. This problem has been realised for some time by the LCC, whose requirements can be met by mounting a prismatic bulkhead fitting on to a sunk 4 in. by 4 in. box.

Hot Lamps

In recent months the technical Press has devoted a lot of space to the effects arising from the higher temperatures attained by the new, small envelope lamps, especially when these have included damage to lampholders and the insulation of cables. It is therefore unnecessary to repeat it here, apart from a brief summary of those points which directly affect fitting design. The smaller lamps have been made possible by the development of new cements for bonding metal to glass. A material which could be used up to about 80°C has now been replaced by one with a safe limit of 200°C, and even newer compounds, which can stand 400°C, have been produced experimentally. Since, however, the fire risk due to lamps running at such a temperature must be great, it seems likely that pressure is likely to come from the insurance interests to prevent the present maximum being exceeded. After all, an electric lamp at 400°C is not much less dangerous than a gas burner. It seems curious that, while filament lamps are getting hotter, fluorescent tubes, through increased efficiency, get cooler!

Plastics lampholders were the first components to show the effects of higher temperatures. Phenolic materials, normally used in black and brown, are satisfactory up to about 150°C, but the urea base type, necessary for white and bright colours, has a limit at 80°C, the maximum temperature to be expected with older types of lamp. There have been two reactions on the part of fittings manufacturers. First has been a reversion to metal lampholders with ceramic interiors, whose design has been practically unchanged for more than 70 years; the second, the development of entirely new plastics types, for which provision is made in Supplement No. 1 to BS 52: 1952. Such holders are usually fitted with porcelain interiors, permanently fixed to the metal sleeves, while the moulded parts are in a material which will neither distort nor discolour at temperatures of up to 200°C. Opportunity has been taken by some manufacturers, while designing this new range, to introduce styling in conformity with contemporary trends, resulting in the first major change in the appearance of lampholders since the introduction of plastics in 1926. In order to avoid sticking and jamming of shade rings and skirts, the supplement calls for an 18 t.p.i. screw thread for these, instead of the more usual 26 t.p.i. which was presumably copied from metal holders, but one maker has adopted 12 t.p.i. These improvements have, however, necessitated an increase in price, especially in white and bright colours, for which the most effective plastics so far available is melamine. These now cost rather more than 50% above black or brown (Fig. 7).

Plunger springs are equally affected by heat, whether they are current-carrying or not, and this applies to metal as well as plastics holders. The limiting temperatures are

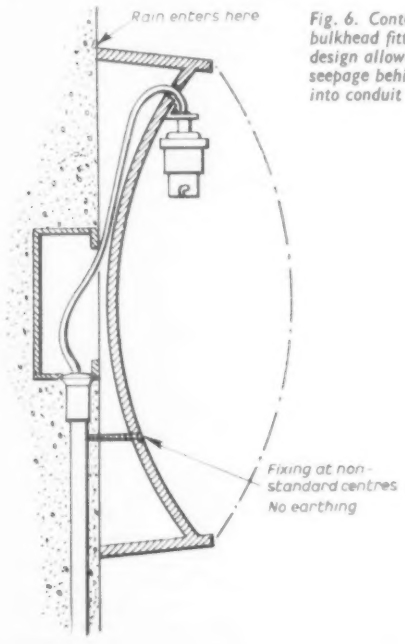


Fig. 6. Contemporary bulkhead fitting of poor design allowing rain seepage behind and into conduit

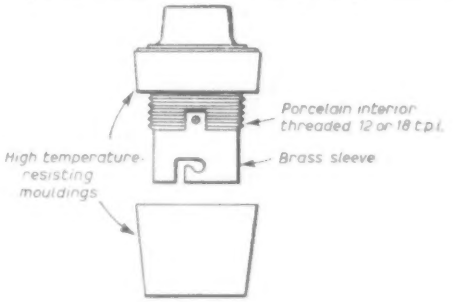


Fig. 7. Modern plastics lampholder with coarse thread, temperature resistant mouldings, brass sleeve and porcelain interior

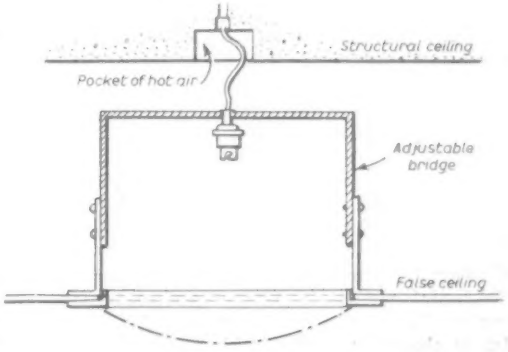


Fig. 8. Hot air trapped in conduit box above a false ceiling will cause deterioration of cable insulation

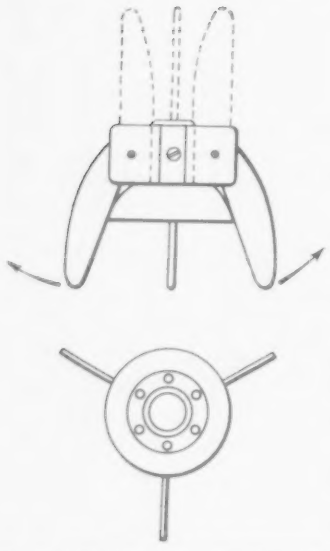


Fig. 9. A simple, ingenious attachment for a contemporary glass lampshade making for easy removal and replacement of the shade without tools

Phosphor bronze 135°C, Spring steel 170°C, Stainless spring steel 200°C.

Fittings mounted directly on the ceiling may get so hot as to damage the insulation of the cables used to wire the building. Even in the old days, it was not unusual to find that v.i.r. cable badly perished where it passed through and immediately behind a wood block, while a few inches away, inside the conduit, it was in perfect condition. It seems that "hot lamps" may produce the same effect in an even more acute form, even with p.v.c. insulation. Where fittings are supplied already wired, the makers of better quality material are now beginning to use silicone rubber insulated conductors, which is certainly a step in the right direction, but if the conduit box immediately above a lamp is open it is likely to act as a trap for hot air and this will, in time, adversely affect the insulation of the cables. This effect may be particularly severe behind the false ceiling of a display window carrying recessed spotlights (Fig. 8).

A Tight Fit

Examination of contemporary designs shows a large number of shades in both glass and metal which are only just large enough to admit a lamp without leaving any space for the fingers to get a proper grip. This used to provide an effective limit to the size of lamp which could be inserted and so kept the temperature down. As it is now possible to use a 100 W lamp where the former limit was 40 W, this safeguard is no longer effective. It is usually easy enough to insert a lamp in such a fitting, but when the time comes to remove it the lampholder unscrews and rotates and the replacement of a burnt-out lamp becomes a major operation. There may be a psychological basis for these designs, presumably the same one which has resulted in the popularity among the young of "pencil" skirts and Edwardian trousers, but a little commonsense could eliminate much of their inconvenience in use. Fig. 11 shows a particularly bad example. The flat end of the lampholder cannot bed properly against the curved surface, so it works loose. Ultimately, the nipple works itself right inside the lampholder, necessitating complete dismantling of the fitting to put it right. To prevent any future recurrence of the trouble, the whole assembly was soldered solidly together. This was done on a "do it yourself" basis. Had it been a normal commercial job for a customer, there would undoubtedly have been a serious complaint about the relation of the labour charge for repairs to the original cost of the fitting. The answer for the manufacturers would appear to be a minor redesign of piece "A" so that it has a flat surface and to fit a shakeproof washer between it and the lampholder. In another fitting of somewhat similar design (Fig. 10) the flex is always in contact with the outside of the metal lampholder and so is subject to overheating. A further minor mystery concerning these last two illustrations is that, although of British manufacture, their bases have fixing holes at 2¼ in. centres and fit neither standard box.

Glassware

In the days of gas lighting, glass globes which were primarily necessary to protect the mantles from draughts, and only secondarily to diffuse the light and provide a decorative appearance, were made with a lip which was held by three screws in a "gallery." Similar galleries, in 2¼ in. and 3¼ in. sizes with 1¼ in. holes for fitting on to b.c. lampholders were also normal electrical accessories. They were a nuisance, too, as, being usually made from the thinnest possible metal, the threads were very liable to strip and the screws fall out, an event which always seemed to take place while the wireman was on the top of a pair of steps. As glass and porcelain technology improved, neater methods of fixing became possible, and interchangeable screw-in glasses for metal and porcelain bases are now commonplace. So much so, in fact, that standardisation of these screw threads, extending the interchangeability to different manufacturers, would appear to be a desirable step. Where the screw fixing is unsuitable, other simple and ingenious devices have been designed. Fig. 9 shows one effective labour-saving fitting for contemporary glassware which has no small parts to get lost.

Conclusion

While the bulk of the above remarks refer to fittings for use with tungsten lamps, relatively little has been said about fluorescent tubes. The reason for this would appear to be that the design of the latter is largely decided by the dimensions and arrangement of the tubes and control gear itself; the artist is only concerned with details. Any fluorescent fitting must be, fundamentally, an engineering job, while the tungsten fitting is perhaps more likely to be "arty-crafty." When an architect designs a building, he often draws the façade first and gets a structural engineer to produce the framework. If the electrical engineer were called in at the corresponding point in the design of lighting fittings a great deal of future trouble, recrimination and disappointment could be avoided.

Fig. 10. Poor design of lampshade with inadequate ventilation, insufficient room for lamp changing and bad cable entry

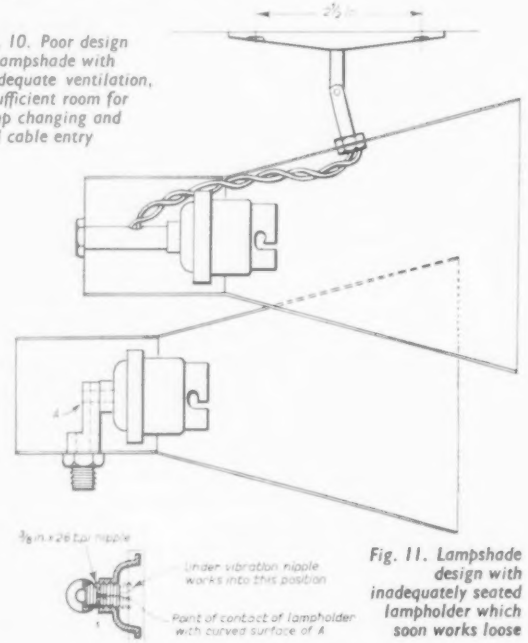
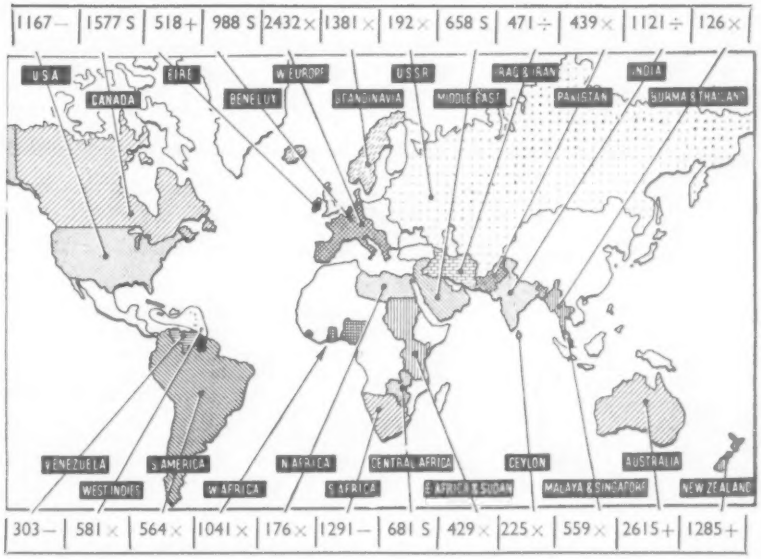


Fig. 11. Lampshade design with inadequately seated lampholder which soon works loose

Distribution of Exports in £'000's Sterling

×=over 25% increase
+=10% to 25% increase
S=10%+ to 10%−
−=10% to 25% decrease
÷=over 25% decrease
on previous year's figures.



EXPORTS IMPORTS

November

NOVEMBER'S exports of all types of electrical goods listed in our table were a record for 1960—being over £2,877,000 up on the previous highest figure, that for the month of January. The total, in fact, is some £4¼ million higher than for October, when some improvement took place following the ending of the tally clerks' strike at London docks. Compared with October, the improvement was reflected in many sections of the industry. The heavy plant side, for instance, showed an increase of £1,800,000, domestic appliances were nearly £1,150,000 up and even cable exports rose by over £600,000, largely in respect of the heavier types of cable.

On the domestic appliance side, exports of washing machines went a step higher, while refrigerators rose to over £900,000, of which £65,000 were taken by South Africa, £97,000 by New Zealand and £84,000 by Western Germany.

Australia was our best customer for the month, taking goods to a value of £2,615,321, Canada following with £1,577,684 and South Africa with £1,291,285. It will also be noted that exports to Western Europe continued their upward trend.

Electrical goods imported during November were also a record in value for the year, but it must be remembered that some £500,000 of the increase was in respect of radio and electronic gear, with most of the goods coming from the USA and Western Germany. But refrigerator imports have shrunk still further.

Description	Exports Value (£)		Imports Value (£)	
	Nov. 1959	Nov. 1960	Nov. 1959	Nov. 1960
Generators				
Diesel up to 200 kW	324,142	439,950		
Diesel over 200 kW	230,647	154,825		
Steam turbine driven	70,147	91,459		
Water and gas turbines	460,423	601,110	103 453	86,400
With i.c. and other prime movers	8,564	189,404		
Generators up to 200 kW	116,501	96,337		
Generators over 200 kW	23,491	38,815		
Generator parts	1,065,056	595,728		
Motors, f.h.p.	299,254	405,775		
Motors 1-250 h.p.	458,970	592,113	156,996	279,980
Other motors	578,563	516,078		
Motor starters and controllers	322,049	291,760		
Converters and rectifiers	70,371	71,650	176,594	183,755
Transformers	1,014,309	863,982		
Switchgear, to 200 A, mv	330,745	388,647	83,399	237,720
Switchgear, other	863,127	1,242,209		
Total, Electrical Plant	*6,246,359*	*6,569,842*	*520,442*	*787,855*
Batteries, primary and parts	564,985	826,765		
Lamps filament, over 28 V	93,115	140,600		
Lamps filament, under 28 V	37,472	59,165		
Fluorescent and other lamps	103,433	129,959		
Radio and electronic gear	4,381,500	4,959,773	1,279,360	1,759,338
Telephone and telegraphic equipment	1,829,842	1,978,420		
Cookers	50,892	47,014		
Toasters	30,508	24,461		
Other cooking appliances and parts	136,351	158,555		
Space heaters	47,038	63,204	131,098	301,626
Water heaters	31,502	28,080		
Other heaters and parts	149,204	165,426		
Electric irons	105,615	115,522		
Vacuum cleaners	156,478	283,821		
Floor polishers	85,546	91,079		
Food mixers	106,774	168,889		
Washing machines, domestic	617,697	908,559		
Dryers		20,383		
Washing machine and dryer parts	96,916	144,905		
Domestic refrigerators and parts	519,303	959,575	151,153	26,635
Other appliances and parts	313,622	663,592		
Total, Domestic Appliances	*2,447,446*	*3,863,065*		
Portable power tools	246,118	424,585		
Arc welding plant	107,792	91,871	48,147	91,224
Resistance welding plant	19,269	47,158		
Electric furnaces	77,854	94,100		
Signalling apparatus	139,510	124,440		
Commercial instruments	190,549	219,474	144,881	418,002
House service meters	177,896	184,280		
Wiring accessories	207,860	246,657		
Fans	125,004	158,943		
Lighting fittings and lanterns	318,043	392,244		
Other lighting equipment	92,013	99,701		
Telephone and telegraph cable	420,671	255,229		
Paper insulated cables	455,384	577,472		
Rubber insulated cables	294,935	284,821		
Thermoplastic insulated cables	283,903	303,630		
Winding and similar wires	149,297	170,638		
Other cables and wires	191,563	265,610		
Total, all cables and wires	*1,795,753*	*1,897,400*		
Accumulators and parts	321,216	318,434		
Insulating materials	234,513	249,916		
Industrial electronic control gear	172,212	236,613		
Electrical ware	118,026	112,630		
Permanent magnets	52,090	79,574		
All other articles	2,691,281	3,507,994	1,507,592	2,206,338
Total	22,781,151	27,033,603	3,782,673	5,591,018

equipment for industry

New transistors

RECENTLY announced is a range of n-p-n "regrown-diffused" silicon transistors for small signal amplifications at medium to high frequencies and as general purpose switching devices. This is the ST721-3 range which is characterised by high values of cut-off frequency, low feedback capacitance and very low leakage currents. Another new development is a range of zener diodes to cover the range of 15 V to 33 V in 20% steps with 10% tolerances. The diodes are of the double-anode type with power ratings up to 25 W at stud temperatures of 50°C with derating at higher temperatures and are designated SZ15B-SZ33B.

Also announced is a 50% cut in price for SCR961-5 silicon controlled rectifiers. *The General Electric Co. Ltd., Magnet Hse, Kingsway, W.C.2.*

"Pyropak" m.i.c.s. accessories

THE latest addition to the range of accessories for use with "Pyrotenax" m.i.c.s. cable is "Pyropak," a package containing 12 pots, complete with sealing compound, anchoring wedge, fibre cap and insulating sleeving, made up as six double-ended sub-assemblies which can be cut to length as required. Currently available for the most popular 440 V and 660 V sizes of cable, it will be extended as demands arise. *Pyrotenax Ltd., Hebburn, Durham.*

Voltage-range indicator

SIMPLE determination of voltage ranges between 50 V and 600 V, a.c. or d.c., is provided by a portable device incorporating four neon tubes. These are arranged to light up successively at each maximum of four voltage ranges. Thus, for 600 V, all tubes will light. The unit has one retractable shrouded probe integral with the case and an additional wander-lead probe. Probe holders contain a fuse and current-limiting resistor. *Martindale Electric Co. Ltd., Westmorland Rd, N.W.9.*

Miniature potentiometer

A MINIATURE rotary potentiometer only ¼ in. high by ½ in. diameter and with single stud fixing 0·45 in. long, the TP 5 is normally available in ten values from 50 ohms to 50 kilohms. The resistance tolerance is ±10% and the unit is capable of dissipating 1½ W at 80°C. It is of the wire wound type and is precision engineered. *Miniature Electronic Components Ltd., The Lye, St. Johns, Woking, Surrey.*

High-voltage resistor

LATEST addition to the "Metox" range of resistors is one designed for operation at high voltages. It has an element of metal oxide bonded to a ceramic former and shrouded with silicone rubber. The resistor is suitable for working at 10 kV d.c. and will withstand certain pulses at voltages up to 50 kV. The shrouding is of sufficient thickness to provide full insulation at working voltages. Resistance values are available to specification between 2 megohms and 500 megohms. Stability under high-voltage working conditions is claimed to be much superior to that achieved hitherto by other types of resistor. The component has dimensions of the order of 2 in. by ⅜ in. dia and can be obtained either with threaded end-caps, for screwing together resistors in series, or with normal wire terminals. *Welwyn Electric Ltd., Bedlington, Northumberland.*

Trunking junction boxes

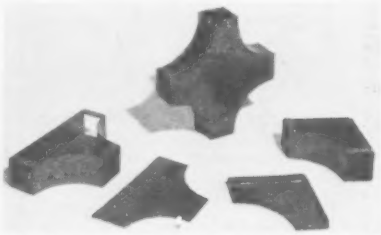
TWO-, three- and four-way junction boxes are available for "Unistrut" channel when used as trunking/support for fluorescent fittings. The boxes are fabricated in 16 S.W.G. sheet-steel finished in olive-green stoved-enamel. They are provided with cover plates ready drilled for fixing screws. Coupling to the "Unistrut" channel is by means of a self-locating screw and nut. *Sankey-Sheldon Ltd., Unistrut Division, 43-45 Broadwater Rd, Welwyn Garden City, Herts.*

New 3½ in. c.r.o.

A NEW high sensitivity cathode ray oscilloscope tube with helical p.d.a. for compact oscilloscopes has just been announced. Only 3½ in. high and with deflection sensitivities of 5·7 V/cm and 30 V/cm in the *y* and *x* ordinates, it is available with various screen phosphors. Price, depending on the phosphor, is of the order of £27. *MO Valve Co. Ltd., Brook Green, Hammersmith, W.6.*

Stroboscopic tachometer

SPECIAL feature claimed for a stroboscopic tachometer recently imported from the USA is that it makes use of a radically new type of strobotron giving short-duration flashes of high intensity white light. This makes it possible to observe in fine detail and natural colour, machines in motion and processes, under normal lighting conditions. The flashing rate can be varied from 110/min to 25,000/min, enabling speed measurement to an accuracy of ±1%, there being three overlapping ranges. Named the "Strobotac," this instrument is compact and portable and should have a wide range of application in industry. Price is £156. *Claude Lyons Ltd., 76 Old Hall St, Liverpool 3.*



▲ *Junction boxes for "Unistrut" trunking are easily fixed with self-locating screw and nut*

◀ *Martindale voltage range neon indicator caters for voltages between 50 V and 600 V*

"Strobotac" gives short duration high intensity flashes enabling observation in fine detail of machinery in motion ▶

for the electrical trade

New magnetic locking 'fridges

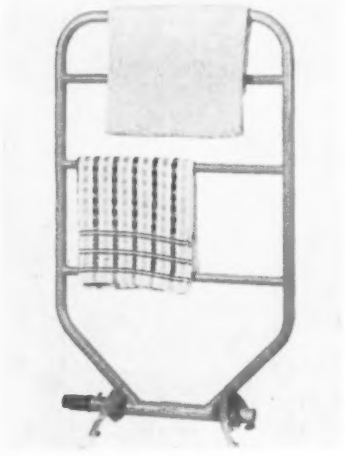
TWO more refrigerators to feature the magnetically locking door, "Polar Star," are announced. They are 4 cu ft and 5 cu ft capacity models, both compressor types incorporating the Tecumseh sealed system which is notable for its quietness in operation. Freezing compartments are three-quarter width and full-width, respectively. Magnetised particles in the gaskets seal the doors when they are pushed to, and allow them to be opened with only slight pressure.

Both cabinets have three adjustable shelves, two-position chill trays, and capacious salad crisper. Door shelves provide the usual accommodation for eggs and tall bottles, as well as full-width covered compartments for dairy produce. Interiors are in beige or blue polystyrene, with a choice of compartment flaps in maroon with gold trim or blue with silver trim. The cabinets have table tops which feature an escutcheon plate at the front incorporating a thumb-operated thermostat dial. Exteriors are all steel, bonderised and finished with two stove-enamelled coats. Prices of these new "Polar Star" refrigerators, which bear the HMV label are £60 18s and £68, respectively. Compressors are guaranteed for five years. *The Gramophone Company, Hayes, Middx.*

Oil-filled towel dryers

TWO new permanently oil-filled towel drying rails are announced, both of which may be wall mounted or free-standing. Pipes formed into a neat rectangle with three cross rails provide four rails each 21 in. wide. The two models are identical in shape, but one (TRC 130) is loaded at 130 W and has a chrome finish, whilst the other (TRC 175) has a 175 W loading and a finish of stove enamel. The latter is supplied in white, cream, turquoise, pink, eau de nil, grey, red, black or bronze. Prices: £15 13s 6d and £10 13s tax paid.

These towel dryers belong to the Dimplex range, which now comprises six models. There are two very small versions, TRC 90 and TRS 120, again chrome and stove enamel, respectively, selling at £12 10s 3d and £8 17s 6d, tax paid. The two largest models are still TRC 150 and TRS 200, which are priced the same as the new pair. The difference between these higher-rated earlier dryers and the new TRC 130 and TRS 175 is that the latter are narrower, but have an extra cross bar and, thus, accommodate the same amount of clothes. *Dimplex, Millbrook, Southampton.*



Left: The new Dimplex oil-filled towel dryer available in 130 W and 175 W ratings. The lower rated model is chrome finished, the higher, stove enamelled. £15 13s 6d and £10 13s tax paid

TRADE PUBLICATIONS

BARBER.—Leaflet on 2 kW convector heater and dryer in one convertible unit. Barber Electrical Services, The Airport, Weston-super-Mare, Somerset.

SIFBRONZE.—Price List No. 11160/N of oxy-acetylene welding products. 23 pages, illustrated. Suffolk Iron Foundry (1920) Ltd., Sifbronze Wks, Stowmarket.

I.C.I. COPPER.—47-page brochure entitled "I.C.I. Rods and Sections—Copper and Copper Alloys," giving details of the properties and applications of copper and brasses. Imperial Chemical Industries Ltd., P.O. Box 216, Birmingham 6.

CRYPTON.—Five new publications. A leaflet on the safety-fast battery servicer AD 43—a portable unit fully equipped for complete service. A 15-page illustrated catalogue of the whole range of battery chargers and battery testers. A folder entitled "Bigger Dividends from Battery Service," for the service station, describing the range of chargers, starters and testers. A folder dealing separately with a range of portable battery testers. Folder describing an engine tester and tuner, "Motor-master," which is now available with new oscilloscope. Checks engine compression conditions and analyses exhaust gases. Crypton Equipment Ltd., Bridgwater, Somerset.

Torch for all weathers

A HOUSEHOLD torch appeared recently which is built to withstand a wide range of adverse conditions without failing. The design was originally introduced in a range of industrial three-cell models—this domestic version is a two-cell type. It is unaffected by water, gas, dust, ice, mud and violent mechanical shock. The key to its long life, it is claimed, lies in the switch mechanism. This is nylon insulated and housed in a rubber-encased head. The torch is operated by rotating the head to "on" or "flash." Corrosion protection is afforded the switch by this type of construction.

The body is solidly constructed with hammer finish and measures 8 in. long. Forming part of the "B.M." range, the torch sells at £1 13s 8½d. *Bardic Ltd., Northam, Southampton.*

'Fridge stays slim at 6 cu ft

ANOTHER refrigerator is added to the "Slimline" range—a 6 cu ft capacity compressor-type model, with automatic interior lighting and a full-width freezer. Continuing the theme of square-cut design, trimmed to minimum dimensions it contains its large capacity within a cabinet only 22½ in. wide. It is fitted with an egg rack, dairy keeper, covered drawer salad crisper and plastics-coated steel-rod shelves with anodised guard rails.

The cabinet, of heavy gauge rust-proofed steel, has a finish of stove enamel and a glass fibre insulation. A useful feature is the provision of screws at the base of the cabinet for levelling adjustment. Temperature of the freezer is specified at 15°F maximum, falling to below 0°F, and is said to store frozen foods for up to three weeks. Reduction in noise is effected by use of internal spring mountings for compressor and motor. Overall dimensions are 41½ in. high by 25⅝ in. deep by 22½ in. wide. Price £84 9s including purchase tax. There is a guarantee of one year on the cabinet and five years on the compressor unit. *English Electric Co., English Electric Hse, Strand, W.C.2.*

Right: A new English Electric "Slimline" refrigerator. A 6 cu ft compressor model. £84 9s tax paid

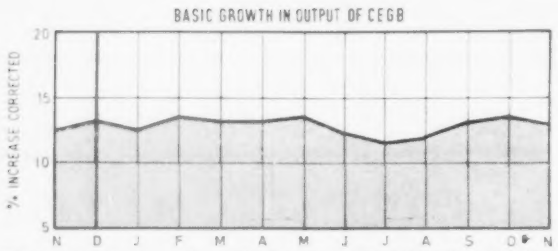
POWER SUPPLY

Statistics for November

NUCLEAR power provided 170 million units in the four weeks ending 29 October, or 55·1% more than in the same period in 1959. From a modest 0·3 million kWh generated at Chapelcross in February, 1959, the output rose to 70·43 million units in February, 1960, and then to nearly 100 million units in August. In November the station produced 94·2 million units or 11·6% of the SSEB district requirements.

During the month, the CEGB generated 10,553 million units. Generation by the SSEB was 673 million units and by the NSHEB 241 million units. The total for the three boards was 12·1% higher than in November last year and the total sent out was 12·2% higher at 10,808 million units.

Only one generating set was commissioned during the month. This was the seventh set at the Drakelow B Station of the East Midlands Division. The installation consists of a 120 MW Parsons turbo-alternator and an 860 klb/hr Foster Wheeler boiler. The total output capacity of the CEGB was 26,387 MW at the end of November and the total for the country, including the two Scottish boards, 29,191 MW, or 5·9% higher than in November, 1959.



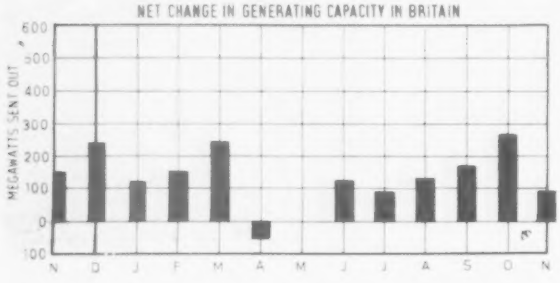
The output capacity of the two Scottish boards has remained unaltered since July. Coal consumption for the three boards rose by 12·1% above November last year to 4,914 thousand tons. Throughout the year, coal stocks maintained at power stations have been between 500 and 1,500 thousand tons below the stocks for 1959, but they have levelled off in the past two months at around 6,500 thousand tons.

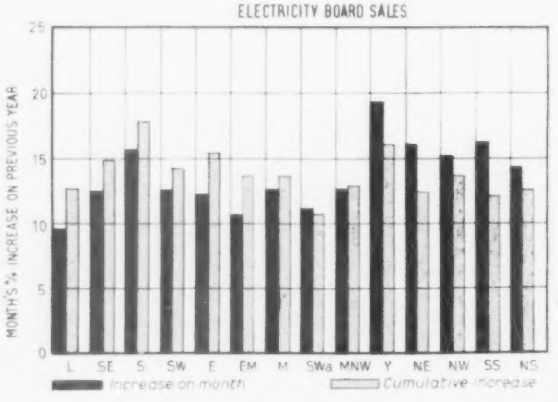
The corrected national increase in units sold was 12·9% for November and follows the trend of the last few months. Although this figure is corrected to allow for the number of working days and the weather conditions, it is only slightly below the actual national increase of 13·1%. The most noticeable increases in units sold are recorded by the North Eastern, North Western and Yorkshire Boards, and vary from 15% to nearly 20%. The SSEB sales also rose considerably, by 16·2%. In the south and midlands sales increases varied from 9% to 12·7% except for the South Western Board where a 15·7% sales rise is recorded. For most area boards, sales increases have been less marked than in the past few months.

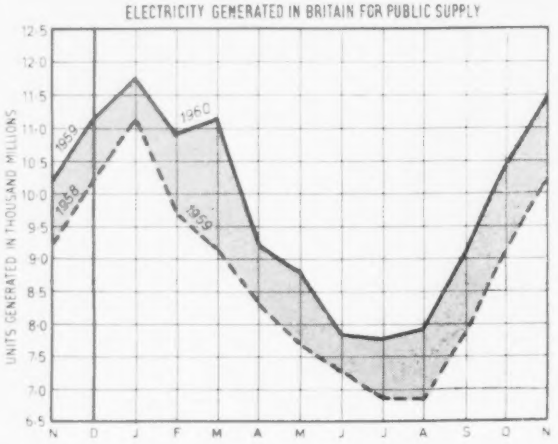
Electricity Board Sales Progress in November

Board	Electricity sent out in millions of units	% increase on Nov. 1959
London	902·0	9·6
South Eastern	615·1	12·5
Southern	833·6	15·7
South Western	370·3	12·7
Eastern	981·2	12·2
East Midlands	803·0	10·7
Midlands	1,073·3	12·6
South Wales	562·3	11·2
Merseyside and N. Wales	609·2	12·7
Yorkshire	1,070·5	19·3
North Eastern	595·6	16·1
North Western	1,036·1	15·1
Direct Supplies by CEGB	316·5	2·8
CEGB Total	9,768·7	13·1
South of Scotland	810·85	16·2
North of Scotland	180·04	14·3

Table excludes area board purchases from other sources







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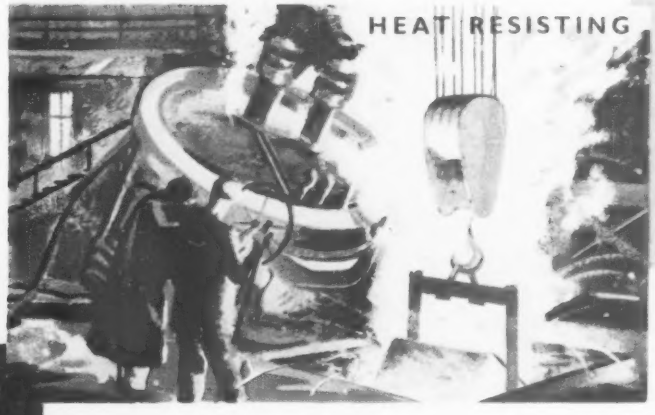

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INSTALLATION EQUIPMENT GROUP HEADQUARTERS FOUR ASHES WOLVERHAMPTON

News of the Week

Bulk Supply Tariff Up

Interim adjustments pending review

INCREASES in both the kW and kWh components of the bulk supply tariff are to be made from 1 April next. The new tariff involves a 3½% increase on the normal fixed charge/kW of maximum demand; and a 2½% increase on the basic kWh tariff. There is no alteration in the coal cost adustment factor. The CEGB say these increases are interim adjustments pending a comprehensive review of the structure of the tariff.

The form of the tariff is unchanged from that applying from 1 April, 1960. It covers supplies from the CEGB to area boards, and is based on a normal kW charge of £7 7s (against £7 2s at present) and a running charge of 0·42d/kWh (against 0·41d/kWh at present). The running charge is varied by 0·00055d for each penny by which fuel cost on average during the year is above or below 60s/ton.

The full tariff (see advertisement page 37) is considerably more complicated than this. To take the kW charge first, this is first of all referred to a notional aggregate of 26,350 MW for all area boards, the charge being shared between boards in proportion to their registered actual demands. This irons out excessive variations due to winter weather. There is a further adjustment to take account of special agreements with large consumers to cut their demands on CEGB instructions as a form of load lopping. A rebate of £4 2s (as against £3 19s at present) will be allowed for each kW of maximum demand a special consumer promises to cut. In other words, there is an increase of 2s in the amount to be paid by an area board for each kW of interruptable demand.

So far as the running charge is concerned, fuel cost/ton is calculated on an involved formula designed to modify the normal rule that fuel cost is estimated on an area basis, by taking into account the proportion of the energy used in an area which is imported from outside the corresponding CEGB division.

In a statement on the new tariff, the CEGB say that the alterations it includes do not imply any change in the long-term trend towards a decreasing running charge, the basic rate for which, they point out, has fallen over five years from 0·5d/unit. They blame the rise on increased costs, including higher interest rates, and wage and salary awards.

The notional aggregate demand used in the tariff shows an increase of 2,350 MW above that for 1960-61.

CABLE TESTING ORGANISATION

LATEST step in the establishment of a British Electric Cable Testing Organisation is the formal registration this month of that title with the word "limited" omitted by licence of the Board of Trade. (The plan to form such an organisation we reported on 6 Aug., 1959.) Mr D. K. Green, of Vernon Hse, Sicilian Ave, W.C.1, is listed as secretary. Named as subscribers to the organisation are: AEI, Aberdare Cables Ltd., Aerialite Ltd., BICC, Enfield-Standard Power Cables Ltd., William Geipel Ltd., General Cable Manufacturing Co., Johnson and Phillips, Permanoid Ltd., Pirelli-General Cable Works, Reliance Electrical Wire Co. and Ripaults Ltd.

Initially, the plan was for co-operation with BSI, NPL and the DSIR in the establishment, if necessary, of a testing station. It was felt that with growing international recognition of standards, and the need to increase export business, a central organisation to issue certificates on cables tested might prove invaluable. But apart from the registration of the title, there is, as yet, no concrete move towards the establishment of such a test house.

Rise for Engineers

INCREASES in pay for employees in the engineering industry were agreed last week. The increases operative from 26 Dec. are 8s 6d/week for skilled men, 8s for semi-skilled, 7s 6d for labourers, and 7s for women. Originally, there was a demand for an all-round increase of £1 per week.

A.E.I. HIVES OFF EXPORT SUBSIDIARY

ASSOCIATED Electrical Industries are mounting a new drive on export markets for consumer goods. From 1 Jan. the appliance exporting company, AEI-Gala, will be a fully independent subsidiary of the parent company instead of being an offshoot of AEI-Hotpoint. A new management company, AEI Appliances Ltd., is being formed to deploy resources for the export drive and to direct AEI-Hotpoint and AEI-Gala.

AEI appliances under the Gala name are already being exported to over 80 countries, and it is understood that AEI Appliances will also boost exports of other consumer goods, such as lamps. Lord Chandos will be chairman of AEI Appliances, and Mr R. Craig Wood will be managing director of this company as well as chairman of AEI-Gala and chairman and managing director of AEI-Hotpoint. Mr D. T. L. Rettie will take full charge of Gala operations throughout the world as managing director of AEI-Gala; previously he was joint managing director of Gala and deputy managing director of AEI-Hotpoint.

132 kV CABLE FOR CENTRAL LONDON

AN order worth some £1¼ million has been awarded to Pirelli-General Cable Works by the CEGB. It covers manufacture, supply and installation of 165,580 yd 132 kV single-core, oil-filled cable, together with 55,000 yd of pilots. The route is from Holborn in London to St. Marylebone, and from St. Marylebone or Finchley to Mill Hill. Most of the cable is 0·60 sq in. conductor size, lead sheathed.

FIRST LOAD SHEDDING?

VOLTAGE reduction as a means of load shedding was admitted by the Midlands Electricity Board last week, and in a statement issued afterwards the chief engineer, Mr G. S. Buckingham, seemed to blame shortage of generating capacity. Later, a spokesman for the CEGB pointed out that at the time of the cuts, voltage and frequency on the grid system were normal and there was spare capacity.

In his statement, Mr Buckingham said: "We are getting new record peak loads, which are temporarily exceeding the capacity of the generating plant available to the CEGB."

Apparent contradiction between MEB and CEGB accounts of what happened may be occasioned by the MEB having taken steps to permit voltage to fall in anticipation of excessive demands on local generating capacity. This action may have limited the demand actually imposed on the CEGB system so that, in fact, initial stages of load shedding by allowing grid voltage or frequency to fall were unnecessary.

There have been warnings lately that if bad weather coincided with continued exceptionally high rate of expansion of demand for electricity, some load shedding might be necessary, but not disconnections. In some parts of the Midlands, industry is making voluntary restrictions in demand. Area boards can arrange local reduction in demand by restricting operation of automatic voltage regulating gear on their distribution networks.

Row Over Kingston By-pass Lighting

THE plan for a uniform lighting system along the Kingston By-pass has met a further setback—Surbiton Borough Council refuse to contribute towards the cost, "in view of their already heavy commitments on lighting other roads." This decision was criticised at the recent meeting of Surrey County Council. The Ministry of Transport had asked the respective Councils to consider using the new 200 W sodium lamps at a height of 35 ft and 170 ft spacing. All the authorities, with the exception of Surbiton, were prepared to provide this modern system.

In the discussion, one member, Mr D. W. Chalkley, said they had "these ten bloodstained miles" yet Surbiton was digging in its heels and refusing to spend money to prevent accidents. "Let Surbiton argue that the money ought to come from the national fund but, in the meantime, for goodness sake let us get on with the job of preventing accidents."

Mr H. W. Edwards, who is also a member of Surbiton Council, explained that that authority felt the By-pass was the responsibility of the Ministry of Transport; it was a national road of no use to Surbiton. There was nothing to show that good lighting would make for road safety. For many years he was chairman of the local Road Safety Committee, and statistics showed that more accidents took place in daylight, with good visibility, than at night. Rain, fog and darkness tended to reduce accidents because, in those conditions, motorists drove more carefully. Improved lighting would make things worse because on a clear, well-lit road a motorist could drive fast, he added.

MR HAXELL GUILTY OF CONTEMPT OF COURT

GENERAL Secretary of the Electrical Trades Union, Mr Frank Haxell, narrowly escaped being sent to prison last week for what Lord Parker described as "a very grave contempt of court." He had circularised branch officials last month, in effect telling them not to disclose information to solicitors of two union members, Mr J. Byrne and Mr F. Chapple, who are bringing a High Court action alleging that Mr Haxell's election as general secretary was invalid and seeking damages for conspiracy.

Lord Parker said such contempt would fully merit imprisonment in the ordinary way. But the court did not wish to prevent the action, due to be heard next term, being properly prepared or to cause delay. That might happen if Mr Haxell were sent to prison. Mr Haxell was warned however that he would go to prison if he interfered again in the action. Mr Haxell and the ETU agreed to send out a new circular disclaiming the November letter.

Mr Haxell was ordered to pay costs of the application both against himself and the union.

Lord Parker also ruled that Mr G. Scott, national officer, committed contempt in references to the action in a speech to shop stewards in London, but no order was made against Mr Scott except that he pay the costs.

Water Purification Film

A CLEAR exposition of the principles of ion exchange processes for water purification is given in an animated colour film, "Ion Exchange," now available from The Permutit Co. The film runs for 27 min and is available on 16 mm track with sound. It is suitable for school instructional purposes.

O.E.C.D. DETAILS

THE Organisation for Economic Co-operation and Development, which is to succeed OEEC (see ELECTRICAL TIMES, last week, page 950) is to have three principal aims: to achieve the highest sustainable economic growth and employment consistent with financial stability; to contribute to sound economic expansion in countries in the process of economic development; and to contribute to the expansion of world trade on a non-discriminatory basis. This is stated in a written Parliamentary answer by the Chancellor of the Exchequer last week.

Plans at present are that the organisation will come into operation in the autumn of 1961.

DIDO MORE POWERFUL

MORE simultaneous high-flux experiments will be possible in Harwell's research reactor DIDO as a result of a new core which the UKAEA brought into use recently. DIDO is used for testing materials and components for future reactor systems, and now has a core consisting of 25 hollow fuel elements each containing 150 grams of fissile U 235. The earlier plate-type fuel elements each contained 115 grams of U 235.

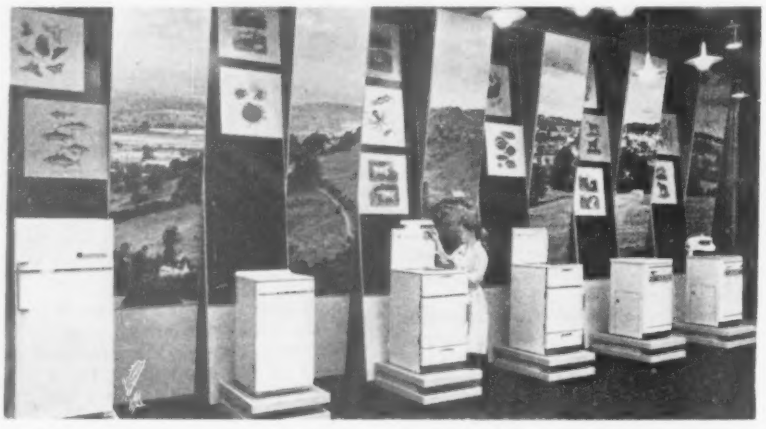
Whereas 27 high-flux experimental positions were available with the earlier arrangement, 52 can now be provided. Maximum thermal neutron flux in the reactor remains at 2 by 10^{14} neutrons/sq cm/sec. Power level of the reactor has increased to 13 MW; this output is removed in the cooling system.

The new arrangement makes it possible to accommodate experimental assemblies for up to 2 in. diameter within the core in regions of extremely high fast-neutron flux. This facility will be of great value for high-dose irradiation damage studies of graphite, fuel canning materials and other components for power-producing reactors. The UKAEA plans to carry out a similar modification to the core of its other Harwell high-flux test reactor, PLUTO, during the coming year. A third reactor of the same general type is DMTR, in use at Dounreay.

Modifications to DIDO were carried out and the start-up procedures performed in the same careful manner associated with start-up of a completely new reactor.

ENGLISH ELECTRIC OPENS STRAND SHOWROOM

THE opening by English Electric of a showroom in their new building in the Strand coincides with the transfer of domestic appliance division headquarters from Kingsway. A panoramic view of the Cotswold countryside decorates the wall facing the Strand, interspersed with black panels bearing coloured tiles to give an illusion of distance as well as providing a back-drop for the appliances, as our picture shows. Bright colours to contrast with the white and cream finish of the products have been used in the décor, with shades of green and grey for the ceiling panels and red for the carpet. There is a separate kitchen for demonstrations and home economists will provide an advisory service.



Each appliance is mounted on a mobile stand so that layout can be easily changed

CENTRAL ELECTRICITY HEATING TAX FREE

ELECTRICALLY heated central heating systems for domestic premises are exempted from purchase tax under a new Order, dated 21 December, made by HM Customs and Excise. The exemption applies to such systems designed for a sustained output of not less than 30,000 B.Th.U./hr, water boilers, and appliances supplied with ducting to transmit heated air to two or more rooms simultaneously. It includes electrode and immersion-types of water boiler, and hot-air generators whether operated by a heat pump or by other forms of electric heating.

The change, outlined in S.I. No. 2351, in effect, eliminates an anomaly which has existed in recent years, and brings the electrical methods into line with coal and gas systems. Previously 25% purchase tax was chargeable, but, in fact, up to a few years ago, p.t. was not charged on such electrode boilers, but in recent years these items were included in the Customs and Excise list.

Bastian and Allen Ltd., one of the electrode boiler pioneers in this country, are primarily responsible for the amendment. Mr J. C. Edwards, sales director, told the ELECTRICAL TIMES last week that they made representations to Customs and Excise on the matter and BEAMA also took up the point.

This purchase-tax exemption is a step in the right direction, but it would also be very useful if more electricity boards welcomed loads of 10 kW to 12 kW on their domestic tariff, he added.

It is stressed that to qualify for exemption, the heating appliance must have a sustained output of at least 30,000 B.Th.U./hr. This applies also to heat pumps which should be capable of such output when sustaining house temperatures not less than 65°F and the ambient temperature is not above 45°F (equivalent to the average day and night air temperature during winter in this country).

Heat pumps which transfer heat from the ground are also covered by the Order, Customs and Excise told the ELECTRICAL TIMES, but it does not include the combined heat pump and refrigerator. Even so, this purchase-tax exemption should aid the advancement of the domestic heat pump which has been retarded mainly by high costs.

Winding Up for "Everest" Appliance Firm

A WINDING-UP order against Merseyside Engineering (Refrigeration) Ltd. was made in the Royal Courts of Justice last week. The petition, put forward by Hans Liebherr, of Western Germany, was in respect of a dishonoured Bill of Exchange for £55,000. Other creditors with £36,000 owing to them by the company, also supported the petition. There are other contingent liabilities.

Merseyside Engineering (Refrigeration) have been marketing "Everest" refrigerators, washing machines, etc., handled appliances made by Hans Liebherr, and planned to set up a factory in Caernarvonshire.

B.S.I. Announces New Projects

NEW standardisation projects announced in the December number of *BSI News* include three of particular interest to the electrical industry. One is a revision of CP 204 on *in situ* flooring. It is contemplated that a section of the revision will deal with the effects of electric floor-warming systems. Another project covers assessment of the corrosion potential of the atmosphere, in which attention will be given to standardisation of methods in the determination of sulphur dioxide pollution often a subject of controversy near power stations. Third in the list comes a proposed standard for recorder chart paper, which is to apply only to non-sensitised papers.

Past activities of BSI are reflected in draft standards published for comment. Those of electrical interest include:

AA(ELE)4880. Electrically heated pads for use in hospitals (3s 6d).

AA(ACE)4953. Glossary of aeronautical terms (revision of BS 185), Section 8. Power plant (5s).

AA(ELE)5269. Methods of test for resistance per unit length of metallic electrical resistance materials (3s 6d).

AA(ACE)5330. Hand-operated circuit-breakers for aircraft. Part 1: Single-pole circuit-breakers (5s).

AA(ELE)5668. Electrically heated equipment for aquaria. Parts 1 and 2 (3s 6d).

These draft standards are available free of charge to subscribing members of BSI, and at the prices quoted to non-subscribing members.

The Institution has reviewed in accordance with its general procedure a number of standards which have been in use for some time and amongst those which it has confirmed as satisfying present requirements is BS 2848:1957 flexible insulating sleeving for electrical purposes.

Draft International Electrotechnical Commission publications which have been received for consideration include one on recommendations for high voltage test techniques.

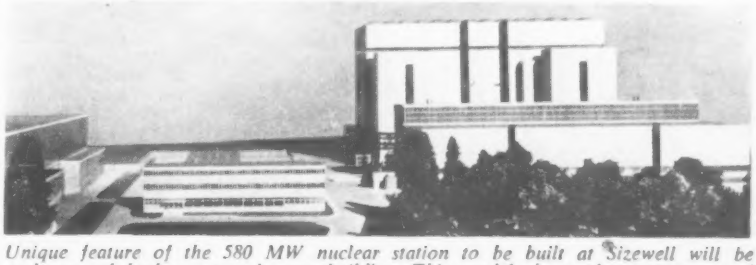
Landguard Point Site

THE news that the CEGB want to acquire Landguard Point, Felixstowe, as a site for a possible power station (reported last week) has annoyed East Suffolk County Planning Committee. The latter, it seems, were not notified direct by the Board of the latter's intentions in the matter, which were published in the local Press. Chairman of the Committee, the Hon C. B. A. Bernard, protested that the Board should not have issued the information initially as it did in the form of a Press report. Mr G. G. Lightfoot, Clerk of the County Council, said there had been correspondence with the Board, but no reference to the proposals had taken the form of an official intimation of their intentions. At the suggestion of the chairman, it was agreed that the Clerk should inform the Board that the Committee did not approve of the way this had been done and if they would notify the Committee officially the latter will deal with it accordingly. Any intention to build a power station would go through the same procedure at Sizewell power station.

OPERATING THEATRE EXPLOSION—£3,147 DAMAGES

DAMAGES of £3,147 were awarded in the High Court to Mrs I. A. J. Hopley for the death of her husband following an explosion in the operating theatre at the Royal Salop Infirmary, Shrewsbury. It was claimed that the explosion occurred when two metal connectors on an anaesthetic machine were separated, creating an electrostatic spark which ignited the anaesthetic.

Mr Justice Pilcher decided Dr Polland was not guilty of negligence and, while he thought it unwise of the Birmingham Regional Hospital Board not to have fitted anti-static rubber, it was impossible to acquit it of failing to make any use of the second safeguard—the humidity of the operating theatre. The spark occurred there because of the dry atmosphere.



Unique feature of the 580 MW nuclear station to be built at Sizewell will be enclosure of both reactors in one building. This model shows the appearance of the station, which is to be constructed for the CEGB by the English Electric-Babcock and Wilcox-Taylor Woodrow group

RAILWAYS TO BE REORGANISED

REORGANISATION of the Transport Commission into four boards plus a holding company for miscellaneous enterprises is proposed in a Government White Paper entitled "Reorganisation of Nationalised Transport Undertakings," published last week. The boards, which will be directly responsible to the Minister of Transport, will cover British Railways, the present services of London Transport Executive the docks, and inland waterways.

Associated with these proposals is provision for reducing to £400 million the existing £1,600 million capital liabilities for which the railways at present have to find interest.

The White Paper says that activities of the BTC as at present constituted are so multifarious that it is impossible to run them as a single undertaking. So far as British Railways are concerned, commercial capability is circumscribed by their statutory obligations and restrictions on trading operations. Mounting deficits and the size of capital debt in relation to earning capacity present a situation "detrimental to the morale of management and workers, to financial control and to hopes of recovery."

In the new organisation, the British Railways board will assume responsibility for running the railways as an effective national system, but will perform only the central functions essential to the running of the railways as a single entity. In particular, the board will be responsible for such matters as wage negotiations, overall control of finance and investment, policies for safety, training and research, and the determination of the future size and shape of the railway system.

There will be regional railway boards, responsible for management and operation of regional railway systems. Each will be autonomous in all matters which concern its region alone.

One of the proposals relating to commercial freedom is that the railways shall be free from statutory control over charges except in the London passenger transport area. This freedom will include freight charges as well as passenger fares.

RAILWAY DISPLAY FOR ELECTRICAL EXHIBITION

BRITISH Railways, possibly in conjunction with London Transport, will be a large exhibitor at the Electrical Engineers' Exhibition to be held at Earls Court from 21 to 25 March. The exhibit will be concerned mainly with communications. A model electric railway, with the latest overhead equipment, will be operated from an actual signal box. Research programmes on equipment for controlling power supply, signalling relays and other facets will be illustrated. The GPO will have an adjacent display, devoted mainly to communications.

WATCH ON IMMERSION HEATERS

SOLIHULL Borough Council is putting its foot down on the installation of immersion heaters in council houses without permission, because of the alterations to the premises usually involved. A circular is being sent to tenants saying a firm order must not be placed with a contractor until the council has given its approval.

OFFICIAL PUBLICATIONS

BS Amendments: 1363 Two-pole and earthing-pin fused-plugs and shuttered socket-outlets for a.c. circuits up to 250 V. PD 3908; 2083: Dimensions of three-phase electric motors (totally enclosed, fan-cooled). PD 3949; 2769: Portable electric tools (hand-held). PD 3970; 2814: Two-pole and earthing pin flush-mounted 13 A switch socket-outlets. PD 3909; 2960: Dimensions of three-phase electric motors with ventilated enclosures. PD 3952.

NCB Specification. Adhesive insulating tape for electrical purposes. 6d.

Purchase Tax (No. 5) Order, 1960. SI No. 2351 (see page 1013).

Reorganisation of the Nationalised Transport Undertakings. HMSO. 1s (see this page).

Pollution from Bromborough

COMPLAINTS about effects of dust containing sulphuric acid emitted from Bromborough power station were made in the House of Commons last week. For the Minister of Housing and Local Government, it was stated that the frequency of such emissions had been reduced in recent years "but the problem has not yet been fully solved." The Alkali Inspectorate was treating research and experiment in the field as a matter of importance and urgency.

TROUBLE WITH HOLME PIERREPONT INQUIRY

LOCAL dissatisfaction with some aspects of the public inquiry into the CEGB's plan to build a 2,000 MW station at Holme Pierrepont, near Nottingham, boiled over into a short House of Commons debate last week. Mr W. Clark, MP for Nottingham South, made four complaints about the inquiry. The first was that the numbers of inspectors conducting the inquiry had changed from two to three, through addition of one extra MoP inspector. Next, the height of the chimneys for the station, originally notified as being 600 ft high, were now said to be going up to 650 ft. Third on the list, there was a complaint that the Ministry of Health was not to be consulted about the effect of emissions from the station; and, finally, dissatisfaction existed about the refusal of the CEGB to justify a claim that siting the station at Holme Pierrepont would bring about a saving of £600,000/year compared with alternative siting.

Detailed answers to each of these points were given by MoP Parliamentary Secretary, Mr J. C. George. One inspector, he pointed out, was acting as an assistant and would not be involved in preparing the final report. The change in height of the chimney had been imposed on the CEGB by the Alkali Inspectorate, despite Air Ministry recommendations of a 600 ft limit. The Minister of Health would, in fact, be consulted by the MoP; but after the report on the inquiry had been received. Finally, the justification of the figure for annual savings was complicated by the refusal of the CEGB to disclose details of private contracts, which they regarded as confidential. They had proposed, originally, that the opponents of the power station might appoint someone competent to examine the calculations on which the estimate was based, and were now willing to extend this offer to include access to the relevant contract documents.

A Lumitron ceiling completely covers the interior of this trailer van, the first of two specially constructed for Imhofs as a mobile showroom for their metal casings, racks, etc. The 9 in. cavity above the diffuser houses 5 ft fluorescent tubes. Power supply is from the mains or the trailer's own generator

M.Ps support Hydro Board

STRONG support for the North of Scotland HEB, and praise for its past achievements, was a feature of a House of Commons debate last week, which centred on the Glen Nevis scheme. In particular, the Scottish Power Investigation Committee, which aims to curtail hydro-electric expansion in the Highlands, came under heavy attack. For the Government, it was stated that if present objections to the Glen Nevis scheme were maintained, there might have to be a public inquiry. So far, 28 formal objections from national organisations and private individuals had been notified.

Start on World Cable in April

WITH the laying of the round-the-world Commonwealth telephone cable expected to start next April, makers of the cables and equipment are busy. Cable and Wireless Ltd.'s new 4,000 ton cable ship *Retriever*, which went down the slipway at Birkenhead on Monday, is due to be commissioned in April and will probably help lay the first section of the cable, from Oban (Scotland) to Newfoundland and on to Canada. She is basically a repair ship and is destined to operate from Fiji, replacing an older ship of the same name at present based on Singapore. Tenders for an 8,000-ton cable-layer for the Government-owned Cable and Wireless will close on 9 Jan. This vessel will take part on the Vancouver-Auckland stretch, due to begin in 1964.

Announcements concerning the awarding of contracts for the manufacture of cable and repeaters for the Pacific section are expected to be made soon. STC made the repeaters for the Scotland-Newfoundland section, and Submarine Cables Ltd., which is jointly owned by AEI and BICC, made the cable.

Sayings OF THE WEEK

"Rain, fog and darkness tended to reduce accidents, because in those conditions motorists drove more carefully. . . . Improved lighting would make things worse because on a clear, well-lit road a motorist could drive fast." . . . MR H. W. EDWARDS, member of Surbiton Council, on Kingston By-pass lighting.

"A balance sheet is essentially no more than a snapshot of the financial position of the business at a particular date." . . . C. BRADSHAW and S. B. HAINSWORTH, chairman and deputy chairman, J. H. Fenner and Co., in their annual report.

"Europe cannot risk another attempt to reach agreement which ends in failure." . . . The PRIME MINISTER, speaking of closer co-operation between the European Common Market and the European Free Trade Association.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Friday, December 23

	£ per ton	Weekly change £		£ per ton	Weekly change £
COPPER, standard class A (settlement)	230½	−6½	ZINC, virgin, min. 98% purity (cash)	81	+¾
" (3 months)	228	−6¼	" (3 months)	81¼	+¼
LEAD, refined pig, 99·97% purity (cash)	64⅜	+⅜	RUBBER, per lb No. 1, RSS, spot	25 3/32d	+1/32d
" (3 months)	65⅛	+⅜	c.i.f. basis, ports, Feb.	24 29/32d	−1/32d
TIN, refined, min. 99·75% purity (settlement)	793	−3½	ARMOURING: Galv. Steel Wire (0·104 in.)	68	—
" (3 months)	791	−3	Mild Steel Tape (0·04 × 1½ in.)	53*	—
ALUMINIUM, ingots 99·99·5%	186	—	NICKEL (home)	600	—
" wire bars (4×4×54")	193½	—	MERCURY (76 lb flask)	69½	—
BRASS Strip 63/37	202½	—	AMERICAN PRICES: Copper, electrolytic (per lb)	30c	—
SILVER (Troy oz)	79 1/16d	—	Lead, (New York)	11c	—

* *Tape Price, now an average, includes varnishing*

LONG-TERM DEVELOPMENT OF HIGHER EDUCATION

LONG-TERM development of universities, colleges of advanced technology and some other centres of further education are to be reviewed by a Government committee under the chairmanship of Professor Lord Roberts. This was announced by the Prime Minister last week. Terms of reference require the pattern of full-time higher education to be reviewed in the light of national needs and resources.

In particular, the committee is to advise whether there should be any changes in the present pattern, and whether any new types of institution are desirable. The inquiry is expected to take two or three years and the Ministry of Education has emphasised that it will not hold up action on any issues such as university expansion which are currently before the Government.

Members of the committee other than the chairman have not yet been announced. Lord Roberts, who is 62, is Professor of Economics at the University of London.

Free Power for London's Christmas Tree

DESPITE impressions given in some London papers the London Electricity Board has undertaken to supply power for lighting the Trafalgar Square Christmas tree free of charge this year and in future years. This statement was made in the House of Commons last week by the Minister of Works, following misunderstandings that the city of Oslo, which has given the tree, might have to meet the cost.

News in Brief

ECC (Moulded Breakers) Ltd. have just fulfilled an order for 6,000 moulded case air circuit-breakers for New Zealand.

"Radio Techniques and Space Research" will be the theme of next year's British Institution of Radio Engineers' convention from 5 to 9 July at the University of Oxford.

The annual dinner/dance of the North Metropolitan branch of the EIBA will be held at St. Albans on 21 April, 1961. Inquiries to Mr A. T. Durbridge, Electricity Offices, 40 Church St, Enfield.

A bulletin of special courses in higher technology for spring and summer terms of 1961 has been issued by the London and Home Counties Regional Advisory Council for Technological Education.

Buttermere, in Lakeland, was given its electricity supply before Christmas, as promised by the North Western Electricity Board.

Sales of TV sets in October rose to 11·3 per shop as against 7·7 in September. Radio set sales rose to 17·6 per shop.

The Rt Hon Patricia Hornsby-Smith, MP (Joint Parliamentary Secretary to the Ministry of Pensions and National Insurance), Guest of Honour at the ASEE Ladies' Evening (reported last week). Also Sir Josiah Eccles (left), and Mr and Mrs G. G. Kitchener

Company Activities

SO another year comes to an end and not very cheerfully for the electrical share market where, on average, values have dropped by something like 30% over the year from the 1960 high point. Nor at the present time do prospects appear particularly promising. 1960 saw very little revival in demand for heavy electrical equipment while, reversing the previous year's boom, some degree of "saturation," the credit squeeze and the intensity of competition in export markets dented the performance at the lighter domestic appliance end. All these conditions persist into 1961 and we cannot, therefore, expect too much in terms of stock market buoyancy.

There is yet no sign that Chancellor Lloyd intends any let-up in the "squeeze," while if we look at estimated retail sales figures for 1960 against manufacturing capacity of 'fridges, washing machines, vacuum cleaners and TV sets we can see that the threat of further short-time working in the industry is very real.

Prospects for exports to take up the slack? Our Commonwealth markets are now feeling the impact of lower commodity prices and are finding their own import bills, therefore, an increasing strain, while in Continental Europe we are just about to witness another 10% reduction in tariffs between the Common Market Six of France, W. Germany, Italy and Benelux. That will mean a 30% reduction in their internal tariffs since January, 1959. Moreover, the first move to align their individual tariffs to the one external common tariff is also due to be made and although that will mean in general that French and Italian rates will be lower, those of Benelux and Germany should be higher. And it will not help UK electrical exporters one little bit to find the German market more difficult than ever to sell in. The need for the newly formed Export Council for Europe has become very apparent as we move into 1961. Happily, it finds our biggest electrical manufacturer right behind it. For last week, AEI chairman Lord Chandos, who is also the president of the export-conscious Institute of Directors, announced new moves to expand the company's exports of domestic appliances. A new management company, AEI Appliances, is being formed to direct the business now carried on through AEI-Gala and AEI-Hotpoint.

Even so, the news did nothing to brighten the £1 Ordinary shares on the London Stock Exchange. At around 40s 3d they are lower than when they started the Christmas week and are now only about 1s above their 1960 "low" to yield 7.4%, nearly the highest in the whole electrical list. News of the AEI transformer trouble on the new Glasgow electric train service, of course, did not help matters and GEC, which had similar sort of trouble recently, were at one time last week down to 29s 6d, only 3d above their "low," before recovering to 29s 9d. English Electric, the odd-man-out therefore, benefited to the tune of going 1s better at 33s 3d, but even here with a dividend yield of 6% the price is only 2s 6d above the "low" and as much as 19s 9d, or 37%, back from their 53s "high." If during 1961 the electrical industry can crack open the world's export markets then these three leaders will bring handsome profits to today's investors. If they fail, today's share prices are reflecting only the beginning of a national crisis.—*From our City Correspondent.*

H. J. Baldwin and Co. Ltd.

This subsidiary of Camp Bird Ltd. suffered a consolidated net loss of £50,462 for the year ended 30 April last after provisions totalling £63,797 and £1,250 taxation charge. The provisions include £36,797 written off stock in a subsidiary company. No ordinary dividend is being paid this time. In the previous 19 months, a net profit of £27,256 was achieved and a 10% dividend paid. The company's normal business is proceeding satisfactorily while the administration and sales divisions are being reorganised with a view to substantial economies in overheads.

Belliss and Morcom Ltd.

There is to be no interim dividend this time and the directors warn that a final dividend for the year is unlikely. (3% was paid last year.) Although the order intake continues to improve, the trend of unprofitable trading continued through the first half-year with substantial losses, they report. This trend has now been arrested, however.

Brazilian Traction, Light and Power

Resuming dividends with 25 cents per Ordinary share, Mr H. Borden, president, states that this should not be taken to mean that the main difficulties confronting the company have been solved. (The last payment, of 25 cents, was in July, 1958.)

Burco Dean Ltd.

Gross profits for the year to 30 Sept. last dropped to £210,000 (*£474,000*) and dividend is cut from 18% to 15%. Preliminary estimates for the current year from 1 Oct. indicate that the group's net profit is lower than for the previous year, it is stated.

British Electronic Industries

The offer made on behalf of this newly formed company to acquire the Preference, Preferred Ordinary and Ordinary stocks of Pye Ltd. and E. K. Cole Ltd. has now been declared unconditional, having been accepted by holders of over 90% of each stock.

British Oxygen Co. Ltd.

Group profit, after depreciation, for the year to 30 Sept. last increased to £9,515,941 from the previous year's figure of £8,587,144. Taxation absorbs £4,439,111 (*£4,065,754*) and outside interests £649,837 (*£585,811*), leaving the sum of £4,426,993 (*£3,935,579*) available to the parent company. The group trading profit is thus slightly higher than that forecast at the time of the recent rights issue, the increase being attributed almost entirely to sales expansion by overseas companies. At home, the greater turnover was offset by higher wages and other costs. A final dividend of 10% is to be paid, making a total of 16%, against 14% last time.

J. H. Fenner and Co. Ltd.

Certain exceptional circumstances and events which cannot be expected to recur aided the increase in the consolidated profit from £236,970 to £373,223 for the year ended 31 Aug. last, both figures being after depreciation and taxation. A further substantial step forward in expansion of productive capacity both at home and overseas is projected, utilising all the liquid resources available to the company. In this step, there is to be a scrip issue of shares next year—the company's centenary year. On the mechanical power transmission business the chairman, Mr C. Bradshaw, and managing director and deputy chairman, Mr S. B. Hainsworth, not only expect more competition at home, but believe there will be more importation of competitive goods from the US—and probably at cut prices. One of the subsidiaries, NGN Electrical Ltd., continues to progress and, next year, will move into the recently purchased Church Bank Mills, Church, East Lancs. Its range of design work has been widened and there is now available complete units for resin impregnation of electrical components, aluminiumising heads for cathode-ray tubes and small degassing units for vacuum casting.

Murex Ltd.

With an interim dividend of 5% for the year to 30 April, 1961, but on increased capital, the directors warn that this should not be taken as indicating any material increase in the total distribution for the year. Present indications are that the group trading results will compare favourably with those of preceding years. Sales of welding electrodes were fully maintained but there were some reductions in sales of welding equipment.

Dividends Declared

Cambridge Instrument Co. Fourth interim of 4% making a total of 16%.

Oldham and Son. Interim 7½% (*same*).

COMMERCIAL INFORMATION

Contracts Open at Home . .

Dates given are the final for receipt of tenders unless otherwise stated.

29 Dec.—Enniskillen R.D.C. Provision of 19 fluorescent lanterns on concrete columns and eight on wood poles.—See 22 Dec. issue.

29 Dec.—Farnborough U.D.C. Lighting and power installations at Jubilee Hall.—See 22 Dec. issue.

30 Dec.—Denby Dale U.D.C. Supply, erection and wiring of 225 25 ft Stanton concrete columns together with 140 W sodium lamps/lanterns/gear along A636 Wakefield Rd and A635 Barnsley Rd.—See 8 Dec. issue.

30 Dec.—Shoreham-by-Sea. Street lighting comprising 13 Group "A" single arm, one double arm 140 W sodium and one post-top fluorescent lantern at High St divided; (1) supply of electrical equipment; (2) taking down existing columns, supply/erection/fitting/wiring of electrical equipment, of own tender; (3) with electrical equipment by another manufacturer.—See 22 Dec. issue.

31 Dec.—Bacup B.C. (a) Electrical work in 29 houses at Tunstead Rd estate, Stacksteads.—See 22 Dec. issue.

2 Jan.—Droitwich B.C. Supply and erection of 52 street lamps, together with lanterns/gear/wiring.—Advertised 15 Dec. issue.

2 Jan.—Romford B.C. Supply of 200 W sodium lamps/lanterns/gear/brackets for conversion of 69 existing units.—See 15 Dec. issue.

2 Jan.—Romford B.C. Tender M26. Supply of lamps for year.—See 15 Dec. issue.

2 Jan.—Saundersfoot. Wiring of village hall.—See 22 Dec. issue.

3 Jan.—Down C.C. (c) Electrical services in new County Grammar School for Girls, Bangor. Applications to Director of Education, County Education Committee, 7 Brunswick St, Belfast 2, by above date.

3 Jan.—Manchester C.C. Contract 300. Electrical installations in 27 dwellings, Churnet St, Collyhurst.—Director of Education, Town Hall.

5 Jan.—Staines U.D.C. Fixed-price basis: Supply, fitting and erection of Class "A" steel columns with 168 mercury fluorescent and 15 fluorescent lanterns, lamps, gear and ancillary work.—See 22 Dec. issue.

6 Jan.—Belfast C.C. (a) Supply of condenser tubes and (b) supply and erection of 25 kW germanium diode rectifier sets (Specifications W184 and 5, respectively).—See 8 Dec. issue.

6 Jan.—Blackpool B.C. Supply of lamps for year.—See 22 Dec. issue.

6 Jan.—Camberwell B.C. Supply of (Item k) lamps and (Item s) cables, conduit and fittings.—See 15 Dec. issue.

6 Jan.—Cardiff C.C. Erection, on fixed-price basis, of 18 30 ft metal, 20 25 ft concrete and metal and 400 Class "B" concrete columns, 180 trolley pole brackets, 35 catenary suspended lanterns and installation of 200 W and 140 W sodium and 80 W and 400 W mercury lamps/gear.—See 22 Dec. issue.

6 Jan.—Edinburgh C.C. All trades or individual trade basis; (5) Electrical work in proposed new pavilion, Wardie Recreation Ground. Applications to City Architect, City Chmbrs, by above date.

6 Jan.—Kilkeel. Electrical installation in Holy Cross Primary School.—See 15 Dec. issue.

6 Jan.—Wanstead and Woodford B.C. Supply of (Item 13) for year—See 8 Dec. issue.

6 Jan.—Wood Green B.C. Supply of (Item 17) lamps.—See 15 Dec. issue.

7 Jan.—Baldock U.D.C. Supply and erection of 11 25 ft concrete columns with 140 W sodium lighting.—See 15 Dec. issue.

7 Jan.—Bath C.C. Supply of (Item 40) l.v. cables; (41) discharge lamps; (42) tungsten lamps and fittings; (43) steel and concrete columns; (44) street lighting lanterns; (45) control gear and capacitors; (46) time switches, for year.—See 8 Dec. issue.

7 Jan.—Dagenham B.C. Supply of (Item 31) lamps for year—See 15 Dec. issue.

7 Jan.—Willesden B.C. Supply of (Item 1) cable, conduit and lamps for year to 31 March, 1962. Borough Engineer, Town Hall, Dyne Rd, N.W.6.

9 Jan.—Hillsborough R.D.C. Electrical installation in erection of sewage disposal works at Newtownbreda. Deposits from consulting engineers: McCandless and Barton, 6 Murray St, Belfast 1. Deposit £3 3s.

9 Jan.—Skipton U.D.C. Rewiring of 83 pre-war houses, Shortbank Rd. Engineer and Surveyor, Town Hall. Deposit £2 2s.—Advertised in this issue.

9 Jan.—Swansea B.C. Two disintegrator sets, pipes, valves, control gear, switches, switchboard, etc., for Limeslade Sewerage Scheme.—See 15 Dec. issue.

9 Jan.—West Lancs R.D.C. (a) Supply of 55 Class "A" and 527 Class "B" concrete columns/brackets; (b) supply of 140 W sodium and M.F. Class "B" lamps/lanterns/transformers/capacitors; (c) erection of columns/brackets, fitting and wiring of electrical equipment and commissioning plus removal of redundant equipment.—Advertised 22 Dec. issue.

10 Jan.—Dunblane B.C. Supply and erection of seven Group "A" concrete columns/lanterns/auxiliary equipment, plus the resiting of six columns along A9.—See 10 Nov. issue.

10 Jan.—Hebburn U.D.C. Electrical installations in 42 houses in central area redevelopment scheme.—See 22 Dec. issue.

10 Jan.—Listowel. (b) Electrical installation comprising 175 lighting points, 90 power points for 170 h.p., five clocks and telephone wiring at new factory at Listowel, Co. Kerry, for Jowika (Ireland) Ltd. Details from consulting engineers: J. A. Kenny and Partners, 44 Kildare St, Dublin. Deposit £15 15s.

11 Jan.—Blyth. Supply of (Item 15) cables and fittings for year to 31 March, 1962.—See 22 Dec. issue.

11 Jan.—Tonbridge R.D.C. Wiring, by registered contractors, of Council Offices and proposed extension.—See 15 Dec. issue.

12 Jan.—Westminster C.C. Supply of lamps for year.—See 22 Dec. issue.

13 Jan.—Doncaster R.D.C. Contract 363, fixed price basis. Supply and installation of 140 W sodium lamps/gear on 25 ft pre-stressed concrete columns (1) 44 units, A1, at Rossington Bridge; and (2) 53 units, A18, Thorne Rd, Edenthorpe. Surveyor, Council Offices, Nether Hall.

13 Jan.—Folkestone B.C. Contract 1(b). Hot-water system installation including electric water heaters and installation of power points for modernisation scheme for pre-war houses. Borough Engineer, Municipal Offices.

13 Jan.—Malden and Coombe B.C. Provision of Group "A" 200 W sodium and fluorescent lighting schemes with tubular steel columns.—See 22 Dec. issue.

14 Jan.—West Lothian C.C. Supply and erection of 25 200 W long type sodium lanterns on 35 ft steel columns/brackets along A8, near Bangour Hospital.—See 22 Dec. issue.

16 Jan.—Bermondsey B.C. Supply of lamps for year.—See 8 Dec. issue.

16 Jan.—Birmingham Tame and Rea. Three 1,500 g.p.m., two 140 g.p.m. and three 70 g.p.m. centrifugal pumps complete with motor control gear.—See 22 Dec. issue.

16 Jan.—Manchester C.C. Supply of (Item 3) fittings, plugs, sockets, connectors, etc. Education Committee, Stores Dept., Chadderton St, Manchester 4.

16 Jan.—Prestwich B.C. Supply of (Item 10) lamps for year.—See 22 Dec. issue.

17 Jan.—Irvine B.C. Supply of 400 three-plate cookers and 400 wash-boilers. Town Clerk: R. Whyte, Council Chmbrs.

17 Jan.—Newcastle upon Tyne C.C. Supply and installation of two automatic passenger lifts in each of two 15-storey blocks of flats at Longbenton Estate.—See 8 Dec. issue.

17 Jan.—Tunbridge Wells B.C. Supply of lamps for year from 1 April, 1961. Borough Surveyor, Town Hall.

19 Jan.—Cregg, Co. Sligo. Electrical installation, including laundry and cooking equipment, motive power supplies, radio distribution, internal telephones and fire alarm system at Home and School of the Immaculate Conception. Details from consulting engineer: J. A. Deasy, 31 Upper Baggot St, Dublin. Deposit £21.

20 Jan.—Aberdare U.D.C. Supply of (Item 14) lamps for year from 31 March, 1961. Engineer and Surveyor, Vestry Hall.

20 Jan.—Belfast C.C. Supply of (Form 1) turbine oil; (2) insulating oil; (3) firebricks, fireclay, etc.; (5) carbon brushes; (6) wire rope; (8) glazed ducts, fibre conduit and covering tiles; (9) distribution and street lighting control pillars; (10) 6·6 kV switchgear; (11) meters, instrument transformers,

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 112 queries answered this week

"Serviscope" oscillographs — address for? C.A.—Telequipment Ltd., 313 Chase Rd, N.14.

"Leesona" coil winding machines—suppliers of? T.E.—Universal Winding Co., Saville St, Oxford Rd, Manchester 1.

"Secraphone" telephones—makers of? A.S.—Telephone Mnfg. Co. Ltd., Hollingsworth Wks, Martell Rd, West Dulwich, S.E.21.

"Adler" sewing machines—agents for? C.E.—L. Linz and Sons Ltd., Park St, Manchester 3.

"Richard" shavers—agents for? E.E.B.—B. H. Ries Ltd., 19-21 Hatton Gdn, E.C.1.

"Fan" washing machines—makers of? G.S.—Couper Works Ltd., Wicklow, Eire.

"Fel" photometers—makers of? T.E.—Evans Electroselenium Ltd., Potter St, Harlow, Essex.

"Cyclone" fans—makers of? E.E.C.—Matthews and Yates Ltd., Swinton, Manchester.

"Master Cook" table cookers—suppliers of? L.E.B.—Warnford Constructions Ltd., Warner St, E.C.1.

"Keepalite" emergency lighting installations—makers of? J.T.—Chloride Batteries Ltd., Exide Wks, Clifton Junction, Swinton, Manchester.

etc.: (12) m.d. indicators; (13) time switches; (14) l.t. fuse units, service cutouts and accessories; (15) distribution transformers; (16) cables, joint boxes, cleats and ferrules; (19) kettles; (21) cookers for year from 1 May, 1961. Documents, fee 10s each form, from Electricity Dept., East Bridge St, Belfast 1.—Advertised in this issue.

21 Jan.—Frimley and Camberley U.D.C. Supply of (a) 90 Group "A" concrete columns and/or (b) 280 140 W sodium lamps/lanterns/control gear. Council Clerk: K. S. Harvey, Municipal Bldgs, London Rd, Camberley.—Advertised in this issue.

23 Jan.—Swansea B.C. Supply of cable, lamps, steel and concrete pillars and other public lighting equipment for year from 1 April, 1961. Borough Engineer and Surveyor, Guildhall.—Advertised in this issue.

28 Jan.—Camborne-Redruth U.D.C. Supply of (Item 24) electrical equipment and fittings for year.—See 8 Dec. issue.

28 Jan.—Rhyl U.D.C. Supply and installation complete of: (a) two 1,560 g.p.m. sewage pumps, two 8,250 g.p.m. and two 12,450 g.p.m. storm water pumps with motors, starters, pipework, valves, etc.; (b) one 500 b.h.p. stand-by diesel-alternator (alternatively, supply only of diesel-alternator).—See 22 Dec. issue.

1 Feb.—Newcastle upon Tyne C.C. Provision of lightning protection for two blocks of 15-storey flats at Longbenton estate, Unit 4 (Chesters Ave). City Architect, 18 Cloth Market.

27 Feb.—Newcastle upon Tyne C.C. (1) Electrical installation and (3) one automatic passenger lift for Home for Aged Persons, Section "D," Montagu estate. City Architect, Cloth Market.

No date stated.—Loch Lee Water Board. Supply and installation of switchboards, wiring, lighting and heating installations for first phase Loch Lee scheme.—See 15 Dec. issue.

No date stated—North of Scotland H.E.B. Supply and erection of 132 kV steel tower double circuit spur line to Burghmuir.—Advertised 8 Dec. issue.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

6 Jan.—Rhodesia and Nyasaland. Stay clips and stay rods. Secretary, Federal Tender Board, P.O. Box 8075, Causeway, Salisbury, S. Rhodesia. B.o.T. (ESB/32814 and 5/60).*

10 Jan.—Singapore. Twelve 6·6 kV, 400 A, t.p. extensible type ring main switch fuse units and isolators. Electricity Dept., Singapore City Council. B.o.T. (ESB/33109/60).*

10 Jan.—Singapore. 50,000 yd single core p.v.c cable. Singapore City Council. B.o.T. (ESB/32802/60).*

16 Jan.—S. Africa. Electrical equipment, 19 items, for Technical High School. Secretary, Union Tender Board, 291 Bosman St, P.O. Box 371, Pretoria. B.o.T. (ESB/32834/60).*

30 Jan.—New Zealand. Telephone cable, 50 items. Director-General (Stores Division), G.P.O., Wellington. B.o.T. (ESB/32829/60).*

31 Jan.—India. 11 kV indoor switchgear. Purchase Officer, Trombay Establishment, Mohatta Bldg, Palton Rd, Bombay 1. B.o.T. (ESB/32485/60).*

1 Feb.—New Zealand. 12 miles 50 pairs and 2½ miles 100 pairs 0·020 telephone cable. Director-General (Stores Division), G.P.O., Wellington. B.o.T. (ESB/32859/60).*

10 Feb.—S. Africa. 75 miles telephone cable for Municipal Telephone Dept., Durban. Town Clerk, City Hall, West St. B.o.T. (ESB/32845/60).*

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

F. T. Baughen and Co. Ltd., 40 Amersham Vale, S.E.14. Electrical engineers, etc. Nom. cap.: £500. Dirs.: Fredk. T. Baughen, Victor H. Parsons and James J. Findlay.

British Electric Cable Testing Organisation, Vernon Hse, Sicilian Ave, W.C.1. The income and property of the Organisation whencesoever derived shall be applied solely towards the promotion of its objects. Council: not named. Subs.: Associated Electrical Industries Ltd., Aberdare Cables Ltd., Aerialite Ltd., British Insulated Callender's Cables Ltd., Enfield-Standard Power Cables Ltd., William Geipel Ltd., General Cable Manufacturing Co. Ltd., Johnson and Phillips Ltd., Permanoid Ltd., Pirelli-General Cable Works Ltd., Reliance Electrical Wire Co. Ltd., and Ripaults Ltd.

Cronin Domestics Ltd., 44 Binley Rd, Coventry. Electrical engineers and contractors, etc. Nom. cap.: £1,000. Dirs.: William H. Cronin and May Tompkins.

Electric Wiring and Repair Co. Ltd. Nom. Cap.: £25,000. Dirs.: to be appointed by subs. Subs.: A. G. Staplehurst and R. H. V. Dixon, 4 Throgmorton Ave, E.C.2.

D. T. Evans (Electrical Contractors) Ltd., 90 High St, Ammanford. Nom. cap.: £5,000. Dirs.: Arthur Lawrence and David T. Evans.

F.C.C. Electrical Wholesalers Ltd., Sherwood St, Mansfield Woodhouse, Notts. Nom. cap.: £3,000. Dirs.: Geo. H. Cooper, Bryan Finney, Barry Chapman and Rex Finney.

D. A. Griffiths (Oswestry) Ltd., Whitnel, Chapel St, Oswestry. To take over the business of electrical contractors carried on as "D. A. Griffiths" at 4 New St, Oswestry, etc. Nom. cap.: £12,000. Dirs.: Daniel A. Griffiths, Alice Griffiths and Alice J. Griffiths.

F. R. Hammond (Electrical) Ltd., 61 Grimsby Rd, Cleethorpes, Lincs. Nom. cap.: £1,000. Permanent dirs.: Fdk. R. Hammond and Mrs Joan Hammond.

Frank Hardman Ltd., 43 Buckingham St, Stockport. To take over the business of electrical contractor carried on by F. Hardman at Stockport, etc. Nom. cap.: £1,000. Permanent dirs.: Frank Hardman and Mrs Rose Hardman.

Headland Gauges Ltd., 45-6 Lower Marsh, S.E.1. Nom. cap.: £100. Dirs.: not named. Subs.: Leonard T. P. Headland and John Lauder.

Johnson Electrics (Worcester) Ltd., 2a Farrier St, Worcester. To take over business carried on as "Johnson Electrics" at Worcester, and to carry on business of industrial, automobile, marine and domestic electrical contractors, etc. Nom. cap.: £2,000. Dirs.: Philip E. Johnson, Gerald D. Johnson and Kathleen B. Blundell.

P. J. Shone (Colchester) Ltd., Rutlands, Chitts Hill, Colchester, Essex. Electrical engineers, etc. Nom. cap.: £100. Dirs.: Robert J. Smith and Peter J. Shone.

Simmons Electrical Contracting Co. (Lancs) Ltd., 479 Middleton Rd., Chadderton, nr. Oldham. To take over business carried on as "Simmons Electrical Contracting Company," at Chadderton, etc. Nom. cap.: £100. Dirs.: Derek Simmons and Joan Simmons.

Supermatic (Domestic Appliances) Ltd., 7 Victoria St, Liverpool 2. Manufacturers of and dealers in domestic electrical appliances, etc. Nom. cap.: £5,000. Permanent dirs.: John Shirley, Feleci Forcherio and Michael Sarandis.

Westbourne Electrical Ltd., 8a Grand Parade, Poole Rd, Bournemouth. Nom. cap.: £1,000. Dirs.: Sydney W. Lenegan and Mrs Mary Lenegan.

TRADE NOTES

Changes of Address. As from 1 Jan. the chief accountant's department of the East Midlands Electricity Board will occupy offices at Foxhall Lodge, Foxhall Rd, Nottingham. Telephone: Nottingham 63221.

R. B. Sims Ltd., electrical contractors, are moving to 11 Claremont Rd, West Byfleet. Telephone: Byfleet 43304.

With effect from 1 Jan. the office of the sales department of Doulton Industrial Porcelains Ltd. will be at Wilnecote, Tamworth, Staffs. Telephone: Tamworth 113.

Distributors. Under an arrangement with Easco Electrical (Holdings) Ltd., Simms Motor Units Ltd. will act as official distributors of Easolyte low voltage fluorescent lighting equipment.

New Factory. Erection of the new plant for Schenectady-Midland Ltd., at Four Ashes, near Wolverhampton, is to commence shortly.

Acquisition. Denham's Engineering Co. Ltd., lathe manufacturers of Halifax, have been acquired by Charles Churchill and Co.

CONTRACTS PLACED

Bexley B.C. Wiring 88 houses, Highland Rd estate, London Electricity Board. £3,022.

Manchester C.C. Electrical installation work, Greenwood Rd East, Speed Electric Service (Stoke-on-Trent) Ltd.

Halesowen B.C. Provision of 830 street lighting units, Revo Electric Co. Ltd.

Longbenton U.D.C. Supply and erection of 64 sodium vapour lighting units and 474 post-top filament units for gas conversion scheme. Eng. and Lighting Eqpt. Co. Ltd.

Shoreditch B.C. Public lighting improvements. O. C. Summers Ltd., £1,116. Recommended.

Warrington R.D.C. Provision and installation of Class "B" street lighting. Atlas Lighting Ltd.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Bullet Light. 798,759. Class 11. Torches, electric lamps and electric lamp bulbs therefor. The Ever Ready Co. (Great Britain) Ltd., Hercules Pl, Holloway, N.7.

Collel. 808,294. Class 9. Sound-receiving, reproducing, recording and amplifying apparatus, radiogramophones, gramophones, gramophone pick-ups, gramophone needles, gramophone motors and record changers, etc. Collel Ltd., All Saints Passage, Wandsworth High St, S.W.18.

Cona. 807,969. Class 11. Heating, cooking and refrigerating apparatus. "Cona" Ltd., Felden Wks, Railway Pl, Wimbledon, S.W.19.

Darak. 807,348. Class 9. Electric battery separators. Dewey and Almy Ltd., Elvedon Rd, Park Royal, N.W.10.

Delatrol. 805,976. Class 9. Valves operated automatically by electric current control for use with scientific instruments. Ether Ltd., Tyburn Rd, Erdington, Birmingham 24.

Lesco. 799,387. Class 9. Electrical switches, etc. Lite Electrical Switch Mnfg. Co. (Proprietary) Ltd., 654 12th Rd, Kew Township, Johannesburg, Union of South Africa.

Nobelocar. 807,892. Class 11. Lamps for motor-cars and anti-dazzle devices and reflectors therefor. York Noble Industries Ltd., 1 Great Cumberland Pl, Marble Arch, W.1.

Pigethane. 808,586. Class 9. Insulated wire. Pirelli-General Cable Works Ltd., 343-5 Euston Rd, N.W.1.

Telerator. 790,191. Class 9. Apparatus for indicating and for measuring the flow of liquids. Dukes and Briggs Engineering Co. Ltd., Approach Rd, Barton Dock Rd, Urmston, Manchester.

Utanol. 798,827. Class 17. Insulating varnishes; and synthetic resins and natural resins, all prepared for insulating purposes. Dr Beck and Co., Gesellschaft Mit Beschränkter Haftung, Eiselensweg 7, Hamburg 28, Germany.

BUSINESS PROSPECTS

Aberdeen. Independent Television Authority, 14 Princes Gate, S.W.7, plan TV transmitting station.

Alnwick U.D.C. Tender: Five terrace houses, 12 flats, five maisonnettes, detached house and shop. Architects: W. B. Edwards and Ptnrs, 5 Claremont Bldgs, Eldon Pl, Newcastle.

Armthorpe. Don Valley Education Executive plans £115,626 junior and infants' school in Mere La. Executive Architect, Doncaster.

Ayr. MacTaggart and Mickel, 107 West Regent St, Glasgow C.2, plan 32 houses, Teviot St.

Bangor. Glover and Ptnrs, Francis Hse, Francis St, S.W.1, architect for expansion of Normal College.

Barry. H. Ringham Ltd., Thomas's Yard, Colbrook Rd, Cadoxton, plan three-storey block of 12 flats, Westward Rise.

Basingstoke. Lock Construction Co., King's Rd, Woking, Surrey, plan 48 dwellings at Cranbourne La.

Bolton. John Laing and Son, Mill Hill, N.W.7, plan residential estate on land north of Dalton La.—Yates Building Co., Radcliffe Rd, plan 60 houses, Bradford Park, Hollinswood Rd.

Bournemouth. Kennet (Hotels) Ltd. plan multi-storey block 112 flats at the Crag Head Hotel site, Manor Rd.

Bristol. Maurice J. Morley and Co., 56 Queen Sq, Bristol 1, plan residential development at Cairns Rd.

Burnley. Lord Shuttleworth, Gawthorpe Estate office, Padiham, Lancs, plan 80 Glen View Rd dwellings.

Buxton. District Estates plan residential development at Burbage Old Golf Course.—Nu Home Construction Co., 76 Market St, Chapel-en-le-Frith, plan residential development at Brown Edge Rd.

Carlisle. John Laing and Son, Dalston Rd, plan 37-acre housing estate, Knowsfield.—S. L. Jack, 35 Warwick Rd, Carlisle, architect for offices at Shaddongate for Border Dairy Co.—Corporation to lease site at Willow Holme industrial estate to Eldorado Ice Cream Co., 110 Denton St, Carlisle.

Chelmsford. Percy Bilton, 54-58 Uxbridge Rd, W.5, plan three-storey block of six flats and maisonnettes, Torquay Rd.—A. R. Dannatt and Sons, 65a Duke St, architects for tower block of flats at Melbourne Hse site, Chignall Rd.

Cheltenham. Coldrick, Little and Thompson, plan 13 bungalows and four houses, rear Leckhampton Rd.—Dr A. Goldfoot, Gloucester Rd, plans three blocks of 36 flats, Gloucester Rd.

Chesterfield R.D.C. Rose Cottage Farm housing estate at Cutthorpe to be developed by Council. Surveyor.

Clitheroe. G. K. Wright, 10 Selborn Villas, Bradford 9, plans 46 pairs of houses.

Consett. S. D. Ellison, Consett, plan development for residential purposes, seven acres Benfield Rd land.

Coventry. Furness and Parker, 1 Hangar, Baginton, plan lease of four-acre Stonebridge Highway Industrial Estate site.

Croydon. Wellwood Estates, 2 Sloane Gdns, S.W.1, plan 42 flats on Knighton Hotel site, Pampisford Rd.—Durrington Investment Co., 145 London Rd, Kingston upon Thames, plan 47 flats, South Norwood Hill.—Plus Flats Management Ltd., 74 Seymour Pl, W.1, plan 18 flats at Warham Rd.

Dover. Fremlins, Danes Rd, S.E.5, plan development of land at Lower Rd for houses and flats.

Dunstable. Dolmore Property Investment, 6a Maddox St, W.1, plan 80 flats, rear United Services Club.

Durham C.C. Tender: Seaham Grammar Technical School, Swalwell village hall, Wingate Modern School, Winlaton village hall and planned Winlaton Park Nursery School. Architect.

East Grinstead. Tender: Block of flats at Halsford La: Hilton, Wright and Intram, 11 Campden Hill Rd, W.8, architects.

Enfield. W. Braxton Sinclair, Simmonds and Ptnrs, 45 Whitehall, S.W.1, architects for 16 houses, Wagon Rd, Hadley estate.

Exeter. Sir William Holford and Ptnrs, 2a Angel Court, E.C.2, architects for new halls of residence at Duryard Park estate.

Felling. Chippendale and Edmondson, 37a Tubwell Row, Darlington, architects for offices, cold stores, etc., in William St, for Shepherd and Co.

Folkestone. John Mowlem and Co., 91 Ebury Bridge Rd, S.W.1, plan 44 maisonnettes, four blocks of four flats on site of Castle Bay, Sandgate.

Friern Barnet. W. Reed and Co., 216 Regent's Park Rd, N.3, plan 20 flats, Oakleigh Road North.

Gosport. Percy Bilton, Uxbridge Rd, W.5, plan 14 houses and 13 bungalows, Alverstoke.

Grantham. Welland Manufacturing Co., 2 Kings Newton St, Leicester, plan new factory in Dysart Rd.

Hampshire. Davis Estates, High Rd, Kilburn, N.W.6, plan 40 houses and bungalows at Mulford Hill, Tadley.

Hartburn. R. B. Bainbridge, Prudential Bldgs, High St, Stockton-on-Tees, plan 100 houses.

Hartlepool. Taylor and Evans, 22 Elwick Rd, West Hartlepool, plan 50 and 66 houses, Kings Oswy Drive.

Hartley Wintney, Hants. Mr P. Snell plans residential development on 13 acres of land, Hartley Row.

Hoddesdon. Hubert C. Leach, 131 High St, Cheshunt, plan 200 to 300 Ware Rd houses.

Hove. Feldman and Bennis, 21 Queen Sq, Brighton, architects for 26 flats.—Morgan and Carn, 12 Grand Ave, architects for 96 flats.

Hythe. East Kent Road Car Co., Harbledown, Canterbury, plan 50 Hospital Hill flats.

Kesteven C.C. £42,000 youth centre planned on New Beacon Rd area site, Grantham, Lincs. Architect, Sleaford.

Kingston upon Thames. Surrey C.C. plan Rivermeade secondary boys' school in Richmond Rd to cost over £200,000.

Leicester. Shipley Jayes Ltd., Eastleigh Rd, plan showroom and office block near present jersey fabric factory.—Elmo Stores Ltd. plan demolition of Belgrave Cinema and erection of supermarket on site.

Lindsey C.C. Alterations and improvements to cost £1,000 planned at Lumley Secondary School, Skegness.—Prefabricated single-storey school for backward children planned at Horncastle. Architect, Lincoln.—£5,455 scheme for conversion of Linwood Rd, Market Rasen, building into fire and ambulance station. Architect, Lincoln.

London. Parfitt and Craig Hall, 39 Lombard St, E.C.3, architects for four-storey Ensign St, E.1, building.—Richardson and McLaughlin, 13 Mansfield St, W.1, architects for £50,000 warehouse premises at Houndsditch, E.C.3.—J. Carmichael (Contractors), 331 Trinity Rd, S.W.18, contractors for £75,000 Clifton Terr, N.4, warehouse.—Cyril E. Kenney and Ptnrs, 36 Gloucester Pl, W.1, quantity surveyors for dining room, kitchen and stores at St. Luke's Hospital, Chelsea, for S.W. Metropolitan Hospital Board.—Adams, Holden and Pearson, 38 Gordon Sq, architects to University of London, who plan Commonwealth Hall of Residence in Cartwright Gdns, W.C.1.—Lewis Solomon, Kay and Ptnrs, Thavies Inn Hse, Holborn Circus, E.1, architects for ten-storey office block at Abbeydale Rd junction with North Circular Rd, N.W.10.—Marshall and Tweedey, 36 Blackett St, Newcastle, architects for shops, warehouse and offices at New Cross Cinema site, New Cross Rd, S.E.—Cluttons, 5 Gt. College St, S.W.1, surveyors for complete reconstruction of St. James's Chmbrs and 36 Duke St, S.W.1.—Oscar Garry and Ptnrs, 66 Gloucester Pl, W.1, architects for £125,000 conversion of Greycoat Hse, S.W.1, into commercial premises.—Riley and Glanfield, 6 Raymond Bldgs, Gray's Inn, W.C.1, architects for 12-storey main block of offices and flats with five- and seven-storey wings at Gt. Titchfield St, W.1.—T. M. Burrows and Ptnrs, 44 Bedford Row, W.C.1, plan seven-storey office block at 22 Berners St, Oxford St, W.1.—J. E. Ralph, 1 Gower St, W.1, architect for nine-storey block with five- and three-storey wings of offices at 41 Portman Sq and Portman Mews, W.1.—Covell and Matthews, 34 Sackville St, W.1, architects for supermarket and offices on site of Holy Trinity Church, Beresford St, S.E.18.

Longbenton U.D.C. 78 houses planned, Dudley, and 130, Fordley. Surveyor: A. E. Sweetman, Council Offices, Forest Hall, Newcastle.

Mablethorpe U.D.C. £7,628 café and tea gardens planned on central promenade.

Market Harborough R.D.C. 222-dwelling scheme planned for housing estate at Fleckney. Surveyor.

Melton and Belvoir R.D.C. 20 flats for old people planned, Bottesford. Surveyor, Melton Mowbray, Leics.

Northumberland. J. T. Bell and Son, Market Chmbrs, Market St, Newcastle, plan £700,000 private estate at Cleasewell Hill Guide Post for 365 houses.

Oxford. J. E. Cammell plans three-storey block 24 flats at 68 Hollow Way.

Peterborough. J. K. Monsell (Contractors), Blondvil St, Coventry, plan 96 houses at Northborough, Barnack.

Poynton. George Wimpey and Co., Hammersmith Grove, W.6, plan housing developments at Yew Tree Farm.

Richmond. Davis Estates, 346 Kilburn High Rd, N.W.6, plan 70 to 100 flats and new hotel on Palm Court Hotel site development.

Rugby T.C. New highways depot planned in Hunter La at £108,000. Engineer.

Rutherglen. James Laidlaw and Sons, Dalmarnock Rd, Rutherglen, plan £1 million house building development at Bankhead estate for 300 houses.

Scunthorpe T.C. Covered market planned at Ashy new present open market. Surveyor.

Sedgeley. Sedgeley Hall Estates, 1 Ivy Hse La, Coseley, Staffs, plan 66 houses and bungalows at Sedgeley Hall.—Five Oaks Estates, c/o Queen Victoria Rd, Coventry, plan 28 houses, ten bungalows, Straits estate.

S. Shields. T.C. plans 54 bungalows for aged people and community hall adjoining Wenlock Lodge at £93,000. Engineer.

Spilsby R.D.C. Dwellings for old people in Lancaster Ave, Chapel St. Leonards. Surveyor.—34 Wainfleet All Saints and 110 other dwellings planned. Surveyor.

Stockton-on-Tees. J. T. Bell and Sons, Market Chmbrs, Mark St, Newcastle, plan 628 houses in Harrowgate La area.

Sunderland. Newrick and Blackbell, 58 John St, architects for shops at The Green, for A. R. Ridley.—Matkin and Hawkins, Barclays Bank Chmbrs, Fawcett St, architects for Camrex Paints' Hendon Rd office block.

Sutton Coldfield. Hollier Botteley and Co., 14 Temple St, Birmingham 2, plan 32 flats, Dower Hse site.—Industrial Buildings Ltd., Mere Green Rd, Four Oaks, Birmingham, plan three blocks of two-storey flats.—Borough Surveyor's plan for private estates on three sites approved.

Thornaby-on-Tees. Hillier, Parker, May and Rowden, 77 Grosvenor St, W.1, estate agents for Town Centre Securities' scheme for shops scheme in Mandale Rd.

Wallsend. W. B. Edwards and Ptnrs, Claremont Bldgs, Eldon Pl, architects for Denbigh Ave junior school for Northumberland E.C.

Westmorland. Kendal C.C. plan £200,000 comprehensive school at Calgarth, near Windermere.

GAZETTE ANNOUNCEMENTS

COMPANIES ACTS

Albert Miller and Co. (Southport) Ltd. Petition for winding-up to be heard before the High Court of Justice, Strand, W.C.2, on 16 Jan. Persons intending to appear to notify J. E. Baring and Co., Bank Chmbrs, 1 John St, W.C.1, by 1 p.m., 14 Jan.

White and French Ltd. Mr R. Lofthouse, 53 John St, Sunderland, appointed liquidator as from 9 Dec. for the purpose of voluntarily winding-up.

J. W. Booker and Co. (Radio) Ltd. Dividend per £: 4s 6d, payable at 24 Lemon St, Truro, on 5 Jan.

A.J.C. Electrics Ltd. Winding-up order dated 12 Dec.

Jacques (Electrical) Ltd. Winding-up order dated 12 Dec.

S.A.L. Electrical Ltd. Winding-up order dated 12 Dec.

Leamington Electrical Installations. Creditors to send details to liquidator: R. F. Bendall, 126 Colmore Row, Birmingham 3, by 23 Jan.

Arthur C. Symons Ltd. Creditors to send details to liquidator: T. J. Woods, 39 Hermitage Rd, Hitchin, by 31 Dec.

Tilldor Ltd. Petition for winding-up to be heard before the High Court of Justice, Strand, W.C.2, on 16 Jan. Persons intending to appear to notify Cochrane and Cripwell, 119 Finsbury Pavement, E.C.2, by 1 p.m., 14 Jan.

A. W. Sanderson and Co. (Lamps) Ltd. Mr H. Hunt, 52 Frederick Rd, Birmingham 15, appointed liquidator at extraordinary general meeting on 15 Dec. for the purpose of voluntarily winding-up.

Hobson and Hammond (Electrical) Ltd. Mr P. Cardwell, 93 Queen St, Sheffield, appointed liquidator at extraordinary general meeting on 15 Dec. for the purpose of winding-up.

Stem (Elec.) Ltd. Winding-up order dated 12 Dec.

BANKRUPTCY ACTS

Receiving Orders

High Court of Justice. S. J. Bromilow, electrical contractor, formerly carrying on business at 148 North Rd, St. Helens, Lancs. Receiving order dated 9 Dec.

High Court of Justice. A. H. Turner, electrical engineer, carrying on business as Light and Shade, at 24 Crouch End Hill, N.8. Receiving order dated 7 Dec.

Preston. F. J. Woods, electrical retailer, formerly carrying on business at 91 Market St, Chorley. Receiving order dated 13 Dec.

First Meetings and Public Examinations

Bedford. W. A. Badenoch, formerly carrying on business as J. and B. Electrical Appliances at 11 Luton Rd, Wilstead. First meeting: 11 a.m., 29 Dec., at Official Receiver's Office, 15 Guildhall Rd, Northampton; and public examination: 2.15 p.m., 14 Feb., at Shire Hall, Bedford.

Bridgwater. L. A. James, radio and electrical engineer, carrying on business as Domestic Electrics at 42 Clare St. First meeting: 10.30 a.m., 30 Dec., at Official Receiver's Office, 26 Baldwin St, Bristol 1; and public examination: 11.30 a.m., 16 Feb., at County Court Offices, Queen St, Bridgwater.

Macclesfield. C. T. Powell, electrical engineer, carrying on business as George Cooke and Co. at Station Rd, Wilmslow. First meeting: 11.30 a.m., 5 Jan., at Official Receiver's Office, 20 Byrom St, Manchester 3; and public examination: 11 a.m., 28 Feb., at Town Hall, Macclesfield.

Oldham. A. Myers, salesman and electrical appliance mechanic, of 102 Greenwood St. First meeting: 11.30 a.m., 30 Dec., at Official Receiver's Office, 20 Byrom St, Manchester 3; and public examination: 12 noon, 9 March, at Court Hse, Church La, Oldham.

Nottingham. T. K. Underwood, radio, television and appliance retailer, formerly carrying on business in partnership as Fourways Electrical Services, at 68 Carter La, Mansfield, and 18 Market Pl, Shirebrook. First meeting: 11.15 a.m., 29 Dec., at Official Receiver's Office, 27 Regent St, Park Row, Nottingham; and public examination: 10 a.m., 2 March, at Court Hse, St. Peter's Gate, Nottingham.

Appointment of Trustees

Wigan. D. Hodson, hardware and electrical dealer, carrying on business as Service at 71 Shuttle St, Tyldesley. Mr G. H. Eaves, 47 Mosley St, Manchester 2, appointed trustee as from 7 Dec.

Sheffield. F. C. Turner, domestic appliance dealer, electrical and motor engineer, formerly carrying on business as Ross Electrics, Ross Eng. and as Eros Security, at 112 Sepulchre Gate, 14 Bentinck St, 28 Springwell La, Balby, 18 South Parade and Cherry La, Marshgate, all at Doncaster; and at 127 Hessle Rd and 127 Spring Bank, Hull, at 2 Green St, Huddersfield, and at 9 Eldon Terr, Leeds 1. Mr P. Cardwell, 93 Queen St, Sheffield 1, appointed trustee as from 14 Dec.

Intended Dividends

Nottingham. H. Smith, electrical engineer, formerly carrying on business at The Old Bakery, South Clifton. Last day for receiving proofs, by trustee: N. Temple, 185 High St, Lincoln, for intended dividend, 30 Dec.

Rochdale. J. V. Lythgoe and T. O'Brien, appliance dealers, carrying on business as Swift Clean Vac Shop, at 385 Halifax Rd, and 94-96 Cheetham St, Rochdale. Last day for receiving proofs, by trustee: J. A. Freeman, 8 Manchester Rd, Bury, for intended dividend, 12 Jan.

Dividend

Coventry. S. Barnes, electrical contractor, formerly carrying on business at 3 Pim St, Antrim Rd, Belfast. Dividend per £: 8d, payable at Official Receiver's Office, Somerset Hse, 37 Temple St, Birmingham 2, on 30 Dec.

MEETINGS TO NOTE

FRIDAY, 30 DEC.

A.S.E.E. (Coventry and District). "Development of Electrical Equipment for Machine Tools," J. N. Leah. E.M.E.B. Sports and Social Club, Merrick Lodge, Sandy Lane. 7.30 p.m.

MONDAY, 2 JAN.

I.E.E. (S. Midlands). Discussion: "Broadening University Courses." Joint meeting with Education Discussion Circle. James Watt Memorial Institute, Birmingham. 6.30 p.m.

I.E.S. (Birmingham). Display of lighting fittings. Bennett Hall, Y.M.C.A., Snow Hill. 6 p.m.

A.S.E.E. (Leeds). "Application of Electricity to the Control of Oil Burners." Gt. Northern Hotel. 7.30 p.m.

TUESDAY, 3 JAN.

I.E.E. (N. Midlands). "Water-Turbine-Driven Induction Motors," C. L. C. Allan. Leeds and County Conservative Club, South Parade, Leeds. 6.30 p.m.

A.S.E.E. (S.E. London). "Cables and Their Uses," D. Childs. Eltham Green School, Queenscroft Rd, S.E.9. 7.45 p.m.

A.S.E.E. (W. London). "Marine Electrical Equipment," M. Tuke. Windsor Castle Hotel, 134 King St, W.6. 7.45 p.m.

WEDNESDAY, 4 JAN.

I.E.E. (Southern). "The Planning and Economics of Telecommunication Plant," C. J. Stubbington. The University, Southampton. 7 p.m.

I.E.E. (Sheffield). Christmas Holiday Lecture: "Colour Television," R. Feinberg. City Hall, Sheffield. 3 p.m.

I.E.E. (Tees-side). "The Fylingdales Early Warning Station," D. R. Evans. Cleveland Scientific and Technical Institution, Middlesbrough. 6.30 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (Radar Group). "Automatic Techniques in Civil Air Line Communications Systems," W. E. Brunt. London School of Hygiene and Tropical Medicine, Keppel St, W.C.1. 6.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (S. Yorks). "Instruments and Cherry Blossom—Some Impressions of a Technical Visit to Japan," W. C. Heselwood. University, St. George's Sq, Sheffield 1. 7 p.m.

JUNIOR INSTITUTION OF ENGINEERS (Midlands Section). "Engineering in Chemical Works," E. R. Brazier. James Watt Memorial Institute, Gt. Charles St, Birmingham 7 p.m.

A.S.E.E. (Halifax). "Refrigeration." Crown Hotel, Horton St. 7.45 p.m.

A.S.E.E. (Manchester). "Temperature Control," A. P. Bellis. Engineers' Club, Albert Sq. 7.15 p.m.

A.S.E.E. (Preston). "Lighting in Industry," E. J. Smith. R.A.F.A. Club, East View. 7.30 p.m.

THURSDAY, 5 JAN.

I.E.E. Third Hunter Memorial Lecture: "The Application of Electronics to the Electricity Supply Industry," J. S. Forrest. Savoy Pl, W.C.2. 5.30 p.m.

CHELMSFORD ENGINEERING SOCIETY. "The Investigation of Radio Sources at Jodrell Bank," Dr H. P. Palmer. Hoffmann's Social Hall. 7.30 p.m.

I.E.S. (Nottingham). "Light Effect on Dyes," W. L. Lead. Electricity Centre, Carrington St. 6 p.m.

A.S.E.E. (Brighton, Hove and District). "The I.E.E. Wiring Regulations," R. E. Hunter. New Imperial Hotel, First Ave, Hove. 7.30 p.m.

FRIDAY, 6 JAN.

SOCIETY OF INSTRUMENT TECHNOLOGY (Fawley). "Electronics and Instrumentation in the Glass Industry," J. R. Beattie. Admin. Bldg, Esso Refinery. 5.30 p.m.

A.S.E.E. (Liverpool and District). Discussion: "Aspects of Electrical Installations and Modern Building Construction." Industrial Development Centre, M.A.N.W.E.B., Paradise St. 7.30 p.m.

MONDAY, 9 JAN.

I.E.E. (Electronics and Communications Section). "Recent Research in Thermionics," G. H. Metson. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (Western). "Brushless Variable-Speed Induction Motors," E. R. Laithwaite. South Wales Institute of Engineers, Cardiff. 6 p.m.

I.E.E. (N. Eastern). Third Hunter Memorial Lecture on "The Application of Electronics to the Electricity Supply Industry," J. S. Forrest. Neville Hall, Westgate Rd, Newcastle upon Tyne. 6.15 p.m.

I.E.E. (S. Midlands Supply and Utilisation Group). "The Application of Irradiation in Industry," M. C. Crowley-Milling. College of Technology, Gosta Green, Birmingham. 6 p.m.

I.E.E. (N. Staffs Graduates and Students). "Colour Television," P. S. Carnt. Technical College, Stafford. 7.15 p.m.

N.E. ELECTRICAL CLUB. "Unusual Applications of Refrigeration," S. B. Warburton. County Hotel, Neville St, Newcastle upon Tyne. 6.30 p.m.

JUNIOR INSTITUTION OF ENGINEERS (Sheffield and District Section). "Inspection and Testing by Non-Destructive Techniques," D. W. Tasker. Livesey Clegg Hse, 44 Union St, Sheffield 1. 7.30 p.m.

I.E.S. "Modern Aids to Lighting Design—Computer Techniques," H. R. Ruff, H. E. Bellchambers and G. K. Lambert. F.B.I., Tothill St, S.W.1. 6 p.m.

I.E.S. (Sheffield). "Recent Development on the Continent in Exterior Lighting," A. G. Penny. Grand Hotel. 6.30 p.m.

TUESDAY, 10 JAN.

I.E.E. (Measurement and Control Section). "Precision Measurement," G. H. Rayner and A. Felton, supported by "Improvements in the Precision Measurement of Capacitance," G. H. Rayner and L. H. Ford; "The Design of an Audio-Frequency Amplifier for High-Precision Voltage Measurement," S. Harkness and F. J. Wilkins; "The Design and Performance of High-Precision Audio-Frequency Current Transformers," J. J. Hill and A. P. Miller; "Techniques for the Calibration of Standard Current Transformers up to 20 kc/s," J. J. Hill. Savoy Pl, W.C.2. 5.30 p.m.

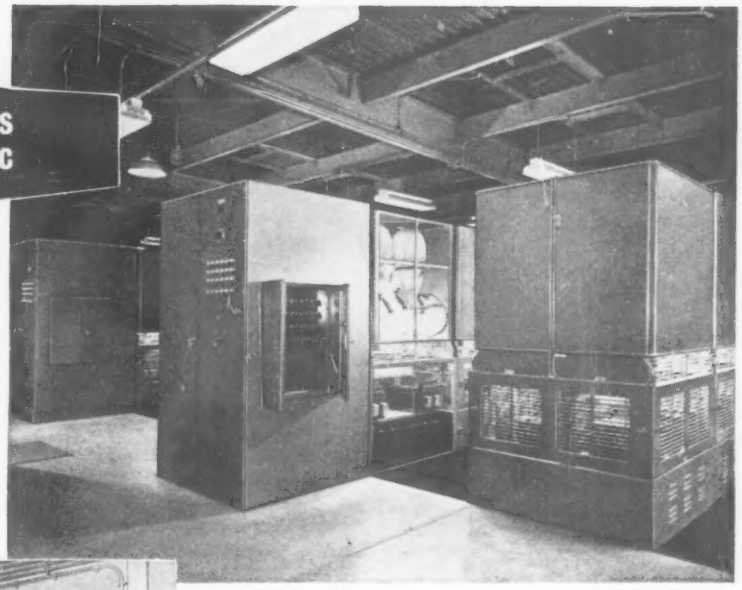
I.E.E. (Southern). Discussion: "New Semiconductor Devices." The University, Southampton. 6.30 p.m.

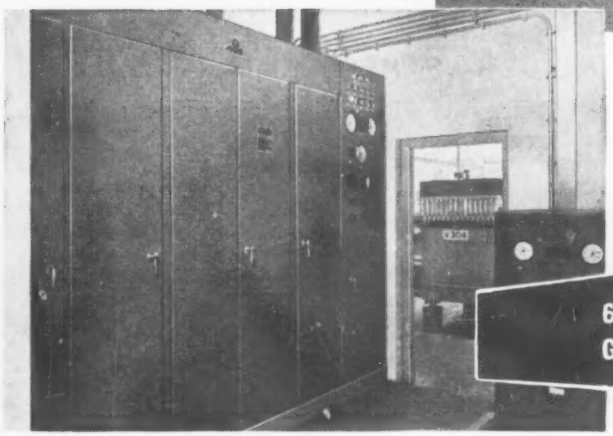
I.E.E. (N. Western). "Radiocommunication in the Power Industry," E. H. Cox and R. E. Martin. Engineers' Club, Manchester. 6.15 p.m.

RECTIFICATION

12,000 AMPS 510 VOLTS MERCURY ARC

A Hewittic Mercury Arc Rectifier installation at the works of Western Chemicals Ltd., Alberta, providing an output of 12,000 amps at 510 volts D.C. for electrochemical duty. This equipment is arranged in three banks, each 12 phase giving 36 phase rectification overall.





A 6000 amp Hewittic Water-cooled Germanium rectifier providing a continuous output at 100 volts D.C. for an electrochemical process at the Luton Works of Laporte Industries Ltd.

6,000 AMPS 100 VOLTS GERMANIUM

MERCURY ARC OR SEMI-CONDUCTOR

HEWITTIC RECTIFIERS

HACKBRIDGE & HEWITTIC ELECTRIC Co. Ltd.
HERSHAM • WALTON-ON-THAMES • SURREY
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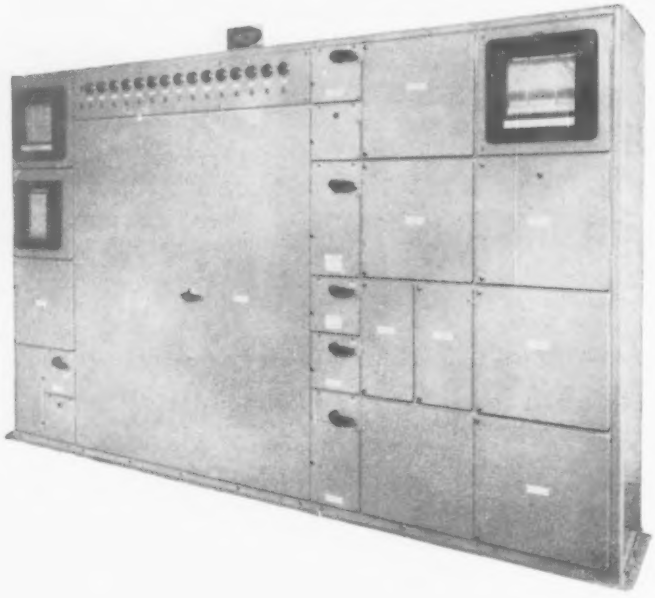
CUBICLE SWITCHBOARDS



OUR CUBICLE AND PEDESTAL TYPE SWITCHBOARDS ARE FLEXIBLE IN DESIGN, NEAT, COMPACT, ARE FRONT ACCESS FOR WIRING AND SAVE MONEY

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OUR RANGE INCLUDES:

- Distribution fuseboards without and with built-in isolators.
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CLASSIFIED ADVERTISEMENTS

TENDERS INVITED

SKIPTON URBAN DISTRICT COUNCIL
Re-wiring of Electrical Installations

TENDERS invited for re-wiring electrical installations at 83 pre-war council houses, Shortbank Rd.

Contract documents from Engineer and Surveyor, Town Hall, Skipton, on deposit of £2 2s (refunded on receipt of bona fide tender).

Tenders, in envelope provided, bearing no indication of sender, to be in by 9 Jan., 1961.

The Council do not bind themselves to accept the lowest or any tender.

L. E. SMITH,
Clerk to the Council.
(T 198)

CITY OF BELFAST ELECTRICITY DEPARTMENT
Stores

TENDERS are invited for the supply of the undermentioned materials during 12 months commencing 1 May, 1961:—

Form No.
1. Turbine Oil
2. Insulating Oil for Transformers and Switchgear
3. Firebricks, Fireclay, Binding Cement for High Temperature Fire Requirements
5. Carbon Brushes
6. Steel Wire Ropes
8. Glazed Stoneware Ducts, Troughing, Pitch Fibre Conduits and Covering Tiles.
9. A.C. Distribution and Street Lighting Control Pillars
10. 6·6 kV Indoor Metalclad Switchgear
11. Meters, Instrument Transformers and Ancillary Equipment
12. Electricity Maximum Demand Indicators
13. Time Switches
14. L.T. Fuse Units, Service Cut-Outs and Accessories
15. Distribution Transformers
16. Vulcanised Bitumen and Paper Insulated Cables, Joint Boxes, Cleats and Ferrules
19. Electric Kettles
21. Electric Cookers

Forms of Tender may be obtained from the Electricity Department, East Bridge St, Belfast, 1, on payment of the sum of Ten Shillings (non-returnable) for each form. Extra copies of the forms may be obtained at Five Shillings each (non-returnable). Cheques should be made payable to the Belfast Corporation Electricity Department.

All letters, catalogues, drawings, etc., accompanying tenders must be submitted in duplicate.

Tenderers are advised that the Corporation Conditions of Contract only will apply. Any other conditions put forward by tenderers will not be accepted.

Tenders, in sealed envelope marked "Tender for Stores, Electricity Committee" and endorsed with the name and address of the firm tendering, must reach the undersigned not later than 4 p.m. on Friday, 20 Jan., 1961.

An official receipt must be obtained for each tender delivered by hand. Tenders sent by post should be registered.

The lowest or any tender will not necessarily be accepted.

JOHN DUNLOP,
Town Clerk.

P.O. Box 234,
City Hall, Belfast 1. (T 200)

COUNTY BOROUGH OF SWANSEA
Tenders for Materials and Haulage

TENDERS are invited for the undermentioned for a period of 12 months from 1 April, 1961.

Bituminous macadam
Bricks
Cement
Concrete (Ready Mixed)
Concrete Kerb
Concrete Paving
Concrete Tubes, etc.
Concrete Materials
Electric Cable (Street Lighting)
Electric Lamps
Engineering Supplies (Bolts, Packing, etc.)
Granite Chippings
Gullies and Frames
Haulage, Motor (Daywork)
Haulage, Motor (Tonnage Rates)
Iron and Steel (Bar, Sheet and Tubes)
Lamp Pillars (Steel)
Lamp Pillars (Concrete)
Manhole Covers and Frames
Mortar
Oils (Lubricating) and Paraffin
Petrol and Fuel Oils
Pipes (Salt-Glazed)
Public Lighting Equipment
Sand and Gravel
Slag and Ashes
Tar or Proprietary Compounds
Tarmacadam
Tyres and Tubes
Walling Stone

Forms of Tender and further particulars may be obtained from the Borough Engineer and Surveyor, Guildhall, Swansea.

Tenders, in envelopes sealed and endorsed "Tender for ....." but which must not bear any name or mark indicating the sender, must reach the undersigned, either by hand (and receipt obtained) or by registered post, on or before 23 Jan., 1961.

The lowest or any Tender will not necessarily be accepted.

IORWERTH J. WATKINS,
Town Clerk.

The Guildhall,
Swansea. (T 199)

FRIMLEY AND CAMBERLEY URBAN DISTRICT COUNCIL
Street Lighting-Supply of Columns and Equipment

TENDERS are invited for the supply of the following:—

(A) Approximately 90 Group "A" concrete street lighting columns, and/or

(B) Approximately 280 140 watt sodium lamps and lanterns and control gear for same.

Tenders are to be delivered to the undersigned in plain sealed envelopes not later than first post on Saturday 21 Jan., 1961.

The Council does not bind itself to accept the lowest or any tender.

K. S. HARVEY,
Clerk of the Council.

Municipal Buildings,
London Rd,
Camberley,
Surrey. (T 206)

APPOINTMENTS VACANT

THE NORTH EASTERN ELECTRICITY BOARD
Area Board Headquarters

APPLICATIONS are invited for the appointment of a

THIRD ASSISTANT ENGINEER

Technical Section, Chief Engineer's Department, with location at Newcastle upon Tyne. Applicants should be suitably qualified Engineers and have had experience in testing, commissioning and maintenance of electrical measuring instruments and protective equipment. Knowledge of the design of electronic devices and circuits will be an advantage.

Salary: Schedule B, Class AX, within the range of Grades 8 to 6, £1,105/£1,500 per annum. N.J.B. conditions of service.

Applications stating age, qualifications and experience to be received by the Assistant Secretary (Establishments), The North Eastern Electricity Board, G.P.O. Box No. 117, Carliol Hse, Newcastle upon Tyne, within 10 days of the appearance of this advertisement. (T 202)

SARAWAK

ASSISTANT CONTROLLER

OF POSTS AND TELEGRAPHS

QUALIFICATIONS: Candidates (not over 45) must be A.M.I.E.E. or Grad. I.E.E. or possess a degree or diploma conferring exemptions from the Institutions's examinations and must have had at least five years' practical experience with a large telecommunications organisation.

DUTIES: The installation and maintenance of all types of telecommunication equipment including 12-, 5- and single-channel V.H.F. and H.F. radio networks and small automatic exchanges.

TERMS: On contract for one tour of three years with salary at appropriate point in the scale £1,386/£2,324. Gratuity payable. Free passages, child education and outfit allowances. Generous leave.

Write Director of Recruitment, Colonial Office, London S.W.1, giving full names, age, qualifications and experience and quoting BCD 108/24/01/D10. (T 211)

CENTRAL ELECTRICITY GENERATING BOARD
Eastern Division

APPLICATIONS are invited for the following appointment:

ASSISTANT ENGINEER
BRADWELL (ESSEX) NUCLEAR GENERATING STATION
(Staff Vacancy No. 1418.)

Salary: N.J.B. Class M, Grade 12, Scale 9, £1,115/£1,245 per annum.

The successful candidate will normally be engaged on general operational duties on day work but will from time to time be required to work on shift for which an addition of 10% will be made to the salary.

Experience in the operation of modern generating station plant, and qualifications to H.N.C. will be an advantage.

Applications, quoting Reference S.V. No. 1418, stating age, qualifications, experience and present position, should be sent to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Pl, Chalk La, Cockfosters, Barnet, Herts, to arrive not later than 7 Jan., 1961. (T 210)

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 46s. per inch, and all other classified advertisements at 3s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

LONDON ELECTRICITY BOARD

CHIEF ENGINEER'S DEPARTMENT
DESIGN AND PLANNING BRANCH

APPLICATIONS are invited for the following posts in the Board's Engineering Drawing Office at Lesco Hse, Stamford St, S.E.1.

SENIOR DRAUGHTSMAN
(Ref.: PER/V/3169/T)

Graded under Schedule B of the National Joint Board Agreement as Class BX, Grade 9, £1,055/£1,375 p.a., inclusive of London Allowance.

Candidates should have a good general and technical education and possess the Ordinary National Certificate in Electrical or Mechanical Engineering and preferably have served an engineering apprenticeship. They should be experienced in the design and layout of main substations incorporating transforming plant and switchgear for capacities of 60 MVA and above.

ENGINEERING DRAUGHTSMEN
(Ref.: PER/V/3170/T)

Graded under Schedule B of the National Joint Board Agreement as Class BX, Grade 12, £820/£1,140 p.a., inclusive of London Allowance.

Duties will include the design and layout of main substations, and candidates should have a good general and technical education and possess the Ordinary National Certificate in Electrical or Mechanical Engineering. They should have experience appropriate to the post and preferably should have served an engineering apprenticeship.

Application forms obtainable from the Personnel Officer, 46 New Broad St, London E.C.2, to be returned completed within 14 days of the publication date of this notice. Please quote appropriate reference. (T 188)

THE SOUTH WALES ELECTRICITY BOARD

DISTRICT MANAGER
RHONDDA DISTRICT

APPLICATIONS are invited for the post of Manager of the Rhondda District in the Cardiff and East Central Area.

The District serves an important and varied community in the Rhondda Valley area.

Experience in a senior position in the Electricity Supply Industry is essential, and applicants should possess a recognised professional qualification.

The salary for the position will be in accordance with Class C, Grade 5, of the National Joint Managerial and Higher Executive Grades Committee, namely, £2,170/£2,380 per annum.

The successful candidate will be required to commence duties on 1 March, 1961.

Applications should be sent to the undersigned at St. Mellons, Cardiff, to arrive not later than 16 Jan., 1961.

Please quote reference 218/60/ET, endorsing envelope "District Manager—Rhondda."

R. G. WILLIAMS,
Secretary.
(T 191)

CHARTERED ELECTRICAL ENGINEER

A VACANCY exists for a Chartered Electrical Engineer with a hydro-electric power undertaking in Northern Nigeria. Pleasant climate, 4,000 ft above sea level. Age 30 to 35. Salary grade £1,335/£1,565 according to age, qualification and experience. Pension and life assurance scheme. Eighteen months' tours with three months' leave on full salary. Free furnished quarters. Free passages self, wife and two children, or equivalent benefits if children remain at home. Write Box E.996, c/o Streets, 110 Old Broad St, E.C.2. (T 128)

LONDON ELECTRICITY BOARD

ENGINEERING DRAUGHTSMAN

APPLICATIONS are invited for the above position in the Board's North Western District at Lithos Rd, Hampstead, N.W.3.

Candidates should have a good general and technical education and be in possession of the Ordinary National Certificate, be neat and capable draughtsmen and be experienced in one or more of the following subjects: drawing office routine, electrical diagrams, layout of plant in transformer chambers, mains survey and recording of mains work. A knowledge of building construction would be an advantage.

The post is graded under Schedule A of the National Joint Board Agreement as Class H, Grade 13, £805/£920 per annum, inclusive of London Allowance.

Applications stating age, qualifications and experience, should be sent direct to the Manager, North Western District, Lithos Rd, Hampstead, N.W.3, to reach his office not later than 14 days from the publication date of this notice. Please quote ref.: PER/V/3168/T. (T 189)

L.C.C. SOUTH EAST LONDON TECHNICAL COLLEGE, LEWISHAM WAY, S.E.4.

VACANCIES for:
(i) LECTURERS and
(ii) ASSISTANT LECTURERS (GRADE B)
in the following subjects:
Electrical Engineering, Telecommunications, Physics and Mathematics.

Candidates should have a degree, industrial experience and preferably some teaching experience.

Salary scales: (i) Lecturer: £1,408/£1,601, possible entry above minimum; (ii) Assistant (Grade B): £738/£1,201, with additions as approved to a possible maximum of £1,486 for degree, good honours and suitable full-time study or research. Point of entry dependent on relevant industrial and teaching experience.

The College offers Full-time, Sandwich, Part-time Day and Evening Courses in Electrical Engineering and Applied Physics.

Application forms from the Secretary, returnable within two weeks, quoting (FE3a/T/3226/12). (T 190)

UNIVERSITY OF WALES
UNIVERSITY COLLEGE OF SWANSEA
Department of Engineering

OWING to the large expansion of the departmental facilities for both teaching and research, a number of appointments will be made to the staff both immediately and from 1 Oct., 1961. Applications are invited from graduates in Engineering, Physics, Metallurgy or Applied Mathematics for the following posts:

ELECTRICAL ENGINEERING
PROFESSOR W. FISHWICK

LECTURER or Assistant Lecturer with special interests in Control Engineering, Electrical Apparatus or related fields.

LECTURER or Assistant Lecturer with interests in any branch of Electrical Engineering, including Theoretical Electro-technics.

Qualifications for, and further details of, these posts are as follows:

LECTURER. Applicants should hold a good Honours degree and have not less than three years' post-graduate experience in research or industrial design. Excellent facilities exist for research.

ASSISTANT LECTURER. Applicants should hold a good Honours degree and have at least one year's industrial or post-graduate experience. Research is strongly encouraged and the assistant may register for a Ph.D. degree.

Salaries are on the following scales, to which are added F.S.S.U. benefits and family allowances:

Lecturer: £1,050 x £50—£1,400 x £75—£1,850 per annum.

Assistant Lecturer: £800 x £50—£950 per annum.

Further particulars can be obtained from the Registrar, University College, Singleton Park, Swansea, by whom applications (two copies) must be received not later than Saturday, 21 Jan., 1961. (T 187)

CASTRIES TOWN COUNCIL

VACANT POST OF
ELECTRICAL ENGINEER

APPLICATIONS are invited for the vacant post of Electrical Engineer, Castries area, St. Lucia, on the following terms and conditions:

1. The post, which is pensionable under existing Civil Service Regulations, is in the salary scale £1,000/£1,500 x £25 per annum. Appointment at a figure above the minimum may be made according to the qualifications and experience of the applicants selected.

2. Applicants should hold a university degree or equivalent diploma in electrical engineering or be Associate Members of the Institution of Electrical Engineers, and should have at least three (3) years' experience in a responsible position with a well-established engineering concern, including experience in the operation and maintenance of diesel engines. Consideration will, nevertheless, be given to applicants not having the academic or professional qualifications stated, but with considerable experience of a high standard.

3. The selected applicant will be required to assume responsibility for the power station and the Council's electric lighting system. He will also be required to lay down any new engines at the power station and carry out any extensions to the existing electrical system, or any other duties pertaining to the generating and distribution of electricity that may be assigned to him by the Council.

4. Free first-class passages to St. Lucia will be provided for the selected applicant, his wife and not more than three (3) children who must be unmarried, under 18 years of age, and dependent on the applicant.

5. Vacation leave is earned at the rate of twenty-eight (28) days per annum, and may be accumulated to a maximum of eighty-four (84) days.

6. Alternatively the successful applicant may be appointed on a three (3) year contract with the possibility of pensionable employment on completion of his contract.

7. The successful applicant will be required to assume his duties on 1 April, 1961.

8. Applications should be addressed to the Town Clerk, Castries Town Council, St. Lucia, West Indies, and should reach him not later than 31 Jan., 1961. (T 212)

CITY AND COUNTY OF NORWICH

ASSISTANT ELECTRICAL ENGINEER

REQUIRED. Salary APT. III (£935/£1,140) according to experience and qualifications.

Applicants must have the Higher National Certificate or be graduates of the Institution of Electrical Engineers, have served an apprenticeship in electrical installation work, and have experience in the design and supervision of interior lighting and power installations.

Applicants should state age, qualifications, training, experience, present and previous positions, together with the names of two referees.

Housing accommodation will be considered in approved circumstances. Applications to the City Engineer, City Hall, Norwich, NOR. 01A, by 13 Jan., 1961. (T 193)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2

SOUTH OF SCOTLAND ELECTRICITY BOARD
Edinburgh and Borders Area
FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEERS
EDINBURGH DISTRICTS

SALARY: N.J.B. Schedule A, Class G, Grade 4, £1,350/£1,500 p.a.

Applications on the standard form, obtainable from the undersigned or any other Area Manager, should be submitted not later than 13 Jan., 1961.

Applicants should preferably be Corporate Members or Graduates of the Institution of Electrical Engineers or possess equivalent qualifications and should have experience in domestic, commercial and industrial applications of electricity and a knowledge of installation work, tariffs, sales and all aspects of service to consumers.

Conditions of service will be in accordance with the National Joint Board Agreement for the Electricity Supply Industry. The successful candidates, subject to satisfactory evidence of health will require to become contributors to the Board's Superannuation Scheme.

In each case the successful candidate will require to reside within a reasonable distance of the District Office.

C. H. A. COLLYNS,
Manager.

52 Melville St,
Edinburgh 3. (T 213)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD
THIRD ASSISTANT COMMERCIAL ENGINEER

REQUIRED at the Board's No. 2 Sub-Area Headquarters, Sandiway Hse, Northwich, Cheshire. Salary within range £1,190/£1,325 per annum (N.J.B. L/10).

Applicants should have completed a recognised Electrical Engineering apprenticeship, and be in possession of at least the Higher National Certificate in Electrical Engineering. Experience in operating a contracting department and carrying out negotiations with all classes of consumers would be an advantage.

Duties will include generally assisting with the technical and administrative work in the Sub-Area Commercial Department, particularly with development in the utilisation of supply by commercial, agricultural and industrial consumers.

Appointment subject to medical examination. Pension Scheme.

Application forms obtainable from the Manager, No. 2 Sub-Area, at the above address. Closing date: 11 Jan., 1961. (T 186)

SOUTH EASTERN ELECTRICITY BOARD
ELECTRICAL FITTER
FOLKESTONE AND ASHFORD DISTRICT

NORMALLY based at Ashford, but must be prepared to work in any part of the district. Wages: 5s 6½d per hour for 42-hour week under N.J.I.C. Agreement. Applicants should be able to work to drawings and should be experienced in the erection and maintenance of E.H.V. and M.V. switchgear and transformers. Applications, quoting ET and naming two referees to District Manager, Seeboard, York Hse, Cheriton Gdns, Folkestone, Kent, by 11 Jan., 1961.

ASSISTANT DISTRICT ENGINEER
WOKING DISTRICT

Salary under N.J.B. Agreement, Class F, Grade 7, £1,040/£1,165 per annum. Superannuable. (Reclassification to Class G possible from 1 April, 1961). Applicants, preferably qualified to H.N.C. Electrical Engineering standard or equivalent, must have had practical training and experience in general distribution work on systems up to 11 kV and be capable of organising and supervising a full construction and maintenance programme. Ability to plan and prepare schemes for mains extensions would be an advantage. Consideration will be given to a private car allowance and in appropriate circumstances to assistance with housing. Applications, quoting ET, on forms from Woking Manager, Seeboard, 4 Chobham Rd, Woking, by 11 Jan., 1961.

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ASSISTANT ENGINEER
GUILDFORD DISTRICT

Salary: £1,040/£1,165 under N.J.B. Class F, Grade 7. Superannuable. Preference given to applicants with technical qualifications up to H.N.C. standard and with practical experience of the planning, construction, operation and maintenance of MV and 11 kV underground and overhead systems. Consideration will be given to a private car allowance and assistance in house purchasing in appropriate circumstances. The successful applicant will be required to undertake standby duties. Applications, quoting ET on forms from District Manager, Seeboard, Woodbridge Rd, Guildford, Surrey, by 11 Jan., 1961.

GEORGE WRAY,
Secretary.
(T 203)

CITY OF BIRMINGHAM PUBLIC WORKS DEPARTMENT
Mechanical & Public Lighting Section

VACANCY for:
ELECTRICAL ENGINEER
Grade APT. IV, £1,140/£1,310 p.a.

Applicants should be Associate Members of the Institution of Electrical Engineers or hold the Higher National Certificate, or the Diploma of the Illuminating Engineering Society (with 5 years' experience).

Candidates should have experience of lighting engineering with particular reference to public lighting.

The post is permanent, superannuable and subject to a medical examination.

Applications stating qualifications, age and experience and naming two referees should reach the undersigned by 14 Jan., 1961.

Canvassing disqualifies.

HERBERT J. MANZONI,
City Engineer and Surveyor.

Civic Centre,
Birmingham 1. (T 208)

THE BRITISH ELECTRICAL & ALLIED MANUFACTURERS' ASSOCIATION

APPLICATIONS are invited from qualified men within the age bracket 30/35 for the post of

TECHNICAL ASSISTANT

in the Switchgear Department at Ascot.

Applicants should have:
(a) a good educational background;
(b) experience with switchgear and ancillary equipment;
(c) administrative ability, personality and tact.

Some familiarity with the work of technical committees and the production of specifications would be an advantage.

A salary will be paid commensurate with qualifications and experience. There is a contributory staff superannuation scheme.

Applications should be addressed to the Secretary of the Association, 36 Kingsway, London W.C.2. (T 209)

GPO

A FIRST-CLASS JOB IN THE G.P.O.

Men between the ages of 20—35 are required to work in Central London on installing and maintaining telephone apparatus and transmission equipment. Older men, up to the age of 45, will be accepted if they have the experience which is particularly suitable.

Commencing pay is £9 16s per week rising to £12 2s.

Men who show ability to progress will be given every opportunity to qualify for Technical Officer posts on which the salary is £600 a year rising to £850. Further promotion is available.

Apply in writing stating age and experience to:

Chief Regional Engineer
(Ref. S/D2A(X2)),
London Telecommunications Region,
Waterloo Bridge House,
Waterloo Road,
London, S.E.1. (T 14)

AN experienced OUTSIDE SALES REPRESENTATIVE, of good education and with a sound electrical background, is required by Crompton Parkinson Ltd. to sell their Induction Motors on his own initiative in the Hull area.

This is a staff appointment, carrying a good salary and pension benefits.

Please apply for application form to MA/P2, Crompton Hse, Aldwych, London W.C.2. (T 179)

DRAUGHTSMAN for electrical and mechanical detail and layout work. Commencing salary dependant on age, experience and qualifications up to £900 per annum.—Fuller Electric Ltd., Fulbourne Rd, Walthamstow, E.17. (T 204)

ELECTRICAL ENGINEER required for maintenance and construction work by a large industrial organisation in Jamaica, W.I. Applicants should have had at least five years' experience of industrial maintenance and electrical installation work in a supervisory capacity. Send applications giving full details and salary required to: Reynolds Jamaica Mines Ltd., Lydford P.O., Jamaica, W.I. (T 181)

ELECTRICIAN required for Plantations Company in Liberia, West Africa. Age 30/45 Married/Single with at least five years' experience, able to supervise and, if required, carry out all types of electrical work, from ordinary wiring to operating Hydro Plant. Previous experience abroad and handling of native workmen preferable. Housing and car provided. Salary $500 per month.—Box No. 8123, Electrical Times. (T 197)

SENIOR ELECTRICAL ENGINEER

Important British Mining Company in West Africa requires a qualified senior Electrical Engineer with experience of power generation and distribution, preferably in relation to mining engineering. He would be responsible to the Chief Engineer for the maintenance of all electrical plant and machinery on the surface and underground and for the installation of all new electrical equipment. Starting salary: £1,800/£2,000; non-contributory pension scheme; 15 month tours, followed by 3 months' leave. Furnished bungalow and car are provided and passages paid. Age 28-40. *Reference Number 143.*

Please reply in confidence, quoting reference number to:—

Robert Clive (Consultants) Limited

Appointments Consultants

27, ALBEMARLE STREET, LONDON, W.1.

(T 201)

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JUNIOR AND ASSISTANT DRAUGHTSMEN, experienced for lighting and power schemes for office, school and hospital buildings. Age 20/25 years. Five-day week, three weeks' holiday. Consulting Engineers, Holborn Area.—Box No. 8125, Electrical Times. (T 205)

M.K. ELECTRIC LTD. invite applications for position of AREA SALES REPRESENTATIVE for East Anglia, covering the counties of Norfolk, Suffolk, Cambridge and part Essex. Applicants must have good education and preferably a thorough knowledge of the marketing and distribution of Electrical Accessories. Application giving full particulars of past experience, age and salary required will be treated in strict confidence if addressed to the Sales Manager, M.K. Electric Ltd., Shrubbery Rd, Edmonton, London N.9. (T 195)

ASSISTANT ELECTRICAL ENGINEER

required for modern expanding Midland company. H.N.C. or better is essential with a sound practical experience of a.c. and d.c. motor control schemes. M.T. distribution layouts, lighting and heavy industrial installations. Salary in accordance with qualifications and experience. —Box No. 8121, Electrical Times. (T 196)

WANTED

WANTED for prompt cash, ferrous and non-ferrous SCRAP: also plant for dismantling. Buyers of second-hand machinery and plant for re-use.—W. and H. Cooper Ltd., 17 Brady St, Bethnal Green, E.1. (T 1)

WORK WANTED

A.C. and D.C. MOTOR REWINDS and REPAIRS. Prompt service, fully guaranteed. Edgware 5566 (4 lines).—Service Electric Co. Ltd., Stanmore, Middx. (T 2)

ELECTRICAL INSTALLATION DESIGN, specifications, estimates, inspection and supervision: qualified and experienced engineer would assist electrical departments on free-lance basis. Prompt service at moderate terms.—Box 8119, Electrical Times. (T 178)

METALWORK.—All types of cabinets, chassis, racks, etc., to your own specification. — Philpotts Metalworks Ltd., Chapman St. Loughborough. (T 11)

APPOINTMENTS WANTED

TECHNICAL REPRESENTATION in S.E. offered by qualified Electrical Engineer on free-lance or part-time basis; own office, transport, etc.—Box No. 8111, Electrical Times. (T 125)

FOR SALE

A.C. and D.C. SLOTMETERS: Time Switches and Quarterly Meters. Single and polyphase, 2½-100 amps. Tested and guaranteed 2 years. Television and Billiards Meters. — Tradex Meter Co., Surbiton. Elmbridge 2234/5/6. (T 9)

A.C. and D.C. MOTORS, GENERATORS from stock.—Service Electric Co. Ltd., Honeypot La, Stanmore, Middx. Edgware 5566/9. (T 4)

A.A. ELECTRICAL CO. for A.C.-D.C. MOTORS. switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—CHI 5105, 67 Rothschild Rd, W.4. (T 3)

ELECTRIC MOTORS, D.C. and A.C. Motor Generator Sets, Alternators and Dynamos. Diesel Sets, Circuit-breakers, Switchboards, reconditioned and guaranteed. Very large stocks held.—Britannia Manufacturing Co. Ltd., Britannia Walk, N.1. CLErkenwell 5512/3/4. Stores at Chobham, Surrey. (T 7)

HOUSE-SERVICE METERS, A.C. or D.C., quarterly or prepayment.—Universal Electrical, 221 City Rd, London E.C.1. (T 5)

HOUSE-SERVICE METERS, all types can be obtained by return from Selectrics, Dept. E.T., Meter Hse, Factory Row, Castle Circus, Torquay. Phone 7218. (T 8)

HIGH QUALITY FORKLIFT TRUCKS!!! PETROL, DIESEL AND ELECTRIC. IMMEDIATE DELIVERY!!!

CONVEYANCER. Petrol. 12 ft lift. 4,000 lb capacity. Solid rubber tyres. £650.

COVENTRY CLIMAX. Petrol. 9 ft lift. 3,500 lb capacity. Recently new solid rubber tyres. £750.

COVENTRY CLIMAX. Petrol. 12 ft lift. 3,500 lb capacity. Twin pneumatic tyres. Recent engine recondition. £775.

STACATRUC. Diesel. 12 ft lift. 5,000 lb capacity. New solid tyres. £950.

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CENTRAL ELECTRICITY GENERATING BOARD

TARIFF FOR BULK SUPPLIES TO AREA BOARDS

fixed by the Central Electricity Generating Board (the Generating Board) pursuant to section 37(1) of the Electricity Act, 1947, for the year ending 31st March, 1962.

NORMAL KILOWATT CHARGE

£7.7s.0d. (seven pounds seven shillings) for each kilowatt of the number ascertained by multiplying by 26,350,000

the maximum number of kilowatts determined by deducting from the **half-hour kilowatt demand** supplied to the Area Board the **half-hour kilowatt demand** of the **special consumers** in the same half hour and adding the sum of the **nominated firm kilowatts** and the **excess kilowatts** (if any) of the **special consumers**

and dividing the product by

the sum of the said maximum number of kilowatts for each Area Board and the chargeable kilowatts in the year of other direct consumers of the Generating Board.

RESTRICTABLE KILOWATT CHARGE

The above Normal Kilowatt Charge less £4.2s.0d. (four pounds two shillings) for each kilowatt of the sum of each maximum **half-hour kilowatt demand** of **special consumers** less the sum of their **nominated firm kilowatts** and less the sum of their **excess kilowatts** (if any).

For the above purposes—

(i) **"the half-hour kilowatt demand"** means twice the number of kilowatt-hours supplied in any half-hour between 7.0 a.m. and 7.0 p.m. on any Monday, Tuesday, Wednesday, Thursday or Friday, or between 7.0 a.m. and 12.0 noon on any Saturday in the year.

(ii) **"special consumer"** means a consumer of the Area Board who has agreed that (without prejudice to any statutory right which the Area Board may have to discontinue the supply of energy) his kilowatt demand can be restricted by the Generating Board for up to 2 hours on any occasion and up to an aggregate of 50 hours in the year provided that

(a) The supply is afforded to the consumer's premises directly from a generating station or substation of the Generating Board through circuits not used for supplies to other consumers

(b) The difference between the consumer's maximum **half-hour kilowatt demand** and his **nominated firm kilowatts** shall be not less than 25,000 kilowatts.

(c) Suitable provisions have been made in respect of the costs of connection and the technical arrangements for operation, control, and metering, which may vary with local circumstances, and

(d) Prior agreement has been made between the consumer the Area Board and the Generating Board in each case.

(iii) **"Nominated firm kilowatts"** means the **five-minute kilowatt demand** which in accordance with the above arrangements the **special consumer** is entitled to make during a period of restriction. For this purpose **"five-minute kilowatt demand"** means twelve times the number of kilowatt hours supplied to the **special consumer** in any consecutive five minutes.

(iv) **"Excess kilowatts"** means the amount by which the **nominated firm kilowatts** is exceeded by twelve times the largest number of kilowatt-hours supplied to the **special consumer** in any five minutes (excepting the first five minutes) during any period commencing when the Generating Board indicate (by a signal or otherwise) that they require his demand to be restricted in accordance with the above arrangements, and ending when the Generating Board indicate that normal supply may be resumed.

RUNNING CHARGE

0.42d. (decimal four two of a penny) for each kilowatt-hour supplied during the year, this charge to be increased or reduced by 0.00055d. (decimal nought nought nought five five of a penny) for each penny (a halfpenny or any greater part of a penny being treated as a penny) by which the fuel cost per ton in the year shall be above or below 60s. (sixty shillings).

For this purpose:

(i) **"Fuel cost per ton"** in any period shall be either

(a) the quotient produced by dividing the aggregate of the product of the **Area fuel cost per ton** in the period and the **number of kilowatt-hours supplied from generation in the Area** in the period, and the product of the **residual cost per ton** in the period and **the number of kilowatt-hours imported into the Area** if any in the period by **the number of kilowatt-hours supplied in the Area** in the period; or

(b) **the Area fuel cost per ton;**

whichever is the less.

(ii) **"The Area"** means the Area of the Area Board taking the supply.

(iii) **"The Area fuel cost per ton"** in any period shall be determined as follows: the total **cost of fuel consumed** in the period at all the Generating Board's stations in **the Area** shall be divided by the total number of tons of **fuel** so consumed and the cost per ton so obtained shall be multiplied by 11,000 and divided by the average gross thermal value of **fuel** so consumed expressed in British thermal units per pound.

(iv) **"Fuel"** shall mean coal, coke and oil fuels but shall not include atomic fuels.

(v) **"The cost of fuel consumed"** shall mean the sums expended for **fuel** consumed plus the cost of any transport, handling preparation or treatment incurred in connection with the delivery of the **fuel** to boiler hoppers or furnaces and in connection with the disposal of the products or residues of combustion, together with the proper proportion of salaries and wages and any contributions for pensions, superannuation and insurance of officers and servants attributable thereto and the amount of any rebate allowed by the suppliers from the price of heavy fuel oil delivered at the Generating Board's stations, such rebate being attributable only to a specific quantity of heavy fuel oil so delivered, less any sums received from the sale of any products or residues of combustion.

(vi) **"The number of kilowatt-hours supplied from generation in the Area"** in any period means the number of kilowatt-hours (being kilowatt-hours generated by the combustion of **fuel**) sent out from all the stations of the Generating Board in **the Area** in the period or **the number of kilowatt-hours supplied in the Area** in the period whichever is the less.

(vii) **"The number of kilowatt-hours supplied in the Area"** in any period shall mean the number of kilowatt-hours supplied in the period by the Generating Board to the relevant Area Board and to other consumers in **the Area.**

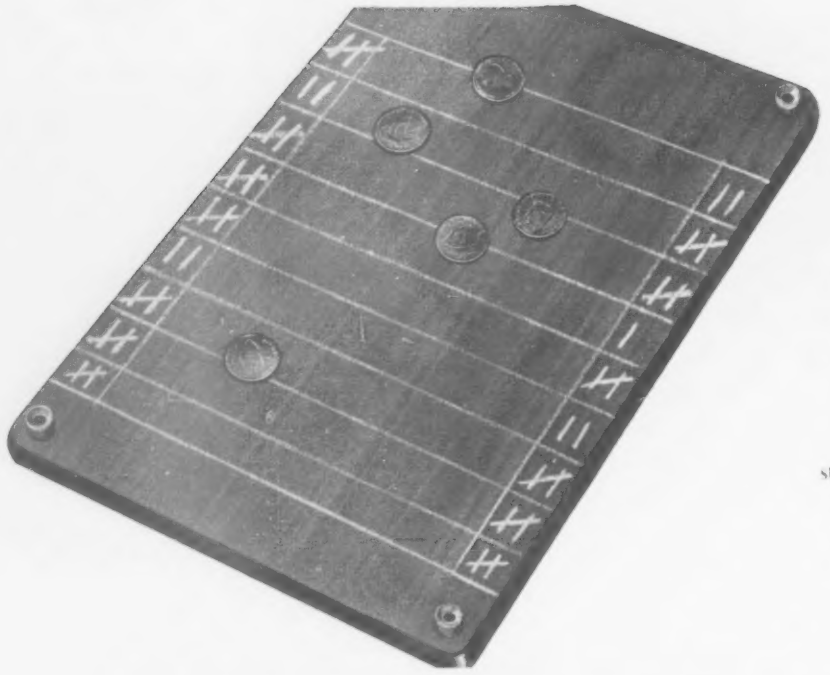
(viii) **"The number of kilowatt-hours imported into the Area"** means the amount if any by which **the number of kilowatt-hours supplied in the Area** exceeds **the number of kilowatt-hours supplied from generation in the Area.**

(ix) **"The residual cost per ton"** in any period shall mean the aggregate of—

(A) The quotient produced by dividing the amount by which **the national fuel cost per ton** in the period multiplied by the aggregate of **the number of kilowatt-hours supplied in the Area** of each Area Board in the period exceeds the aggregate of the respective products in the case of each Area Board of (a) **the Area fuel cost per ton** in the period and (b) **the number of kilowatt-hours supplied from generation in the Area** in the period, by the aggregate of the **number of kilowatt-hours imported into the Area** of each Area Board in the period; and

(B) the sum of 6s. (six shillings).

(x) **"The national fuel cost per ton"** in any period shall be determined as follows: the total **cost of fuel consumed** in the period at all the Generating Board's stations shall be divided by the total number of tons of **fuel** so consumed and the cost per ton so obtained shall be multiplied by 11,000 and divided by the average gross thermal value of the **fuel** so consumed expressed in British thermal units per pound.



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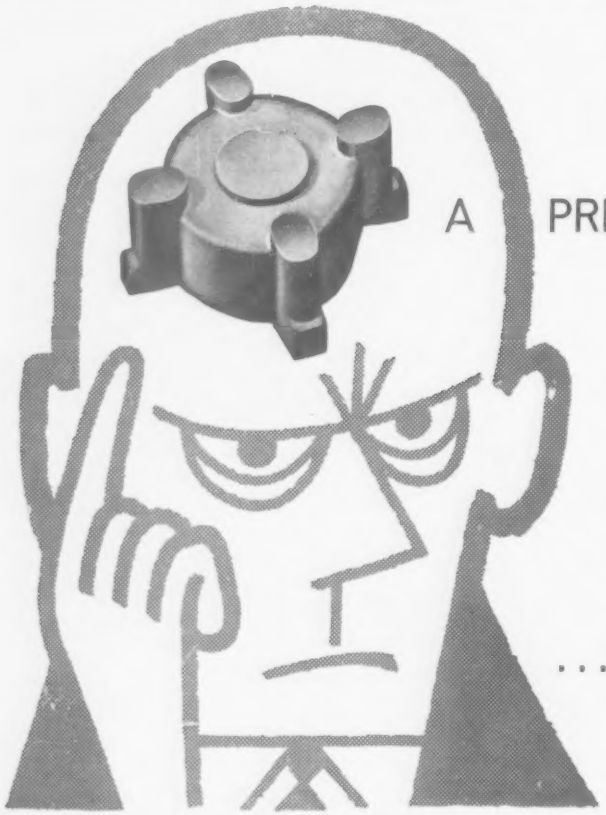

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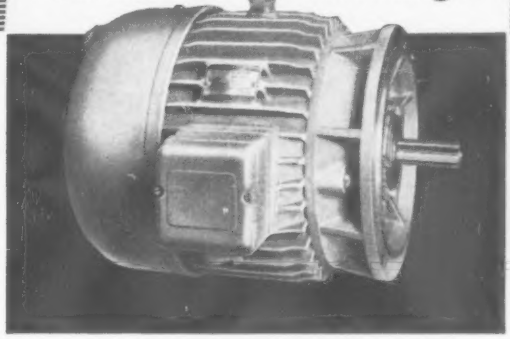

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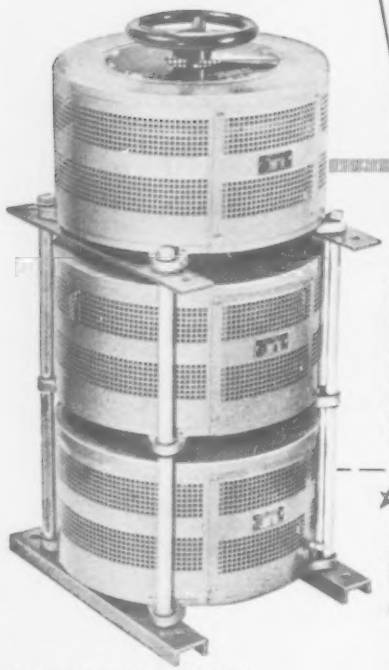

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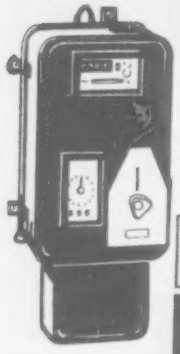

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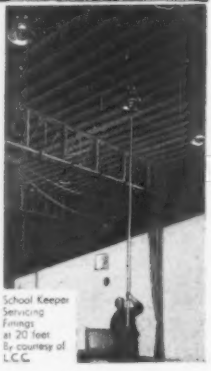

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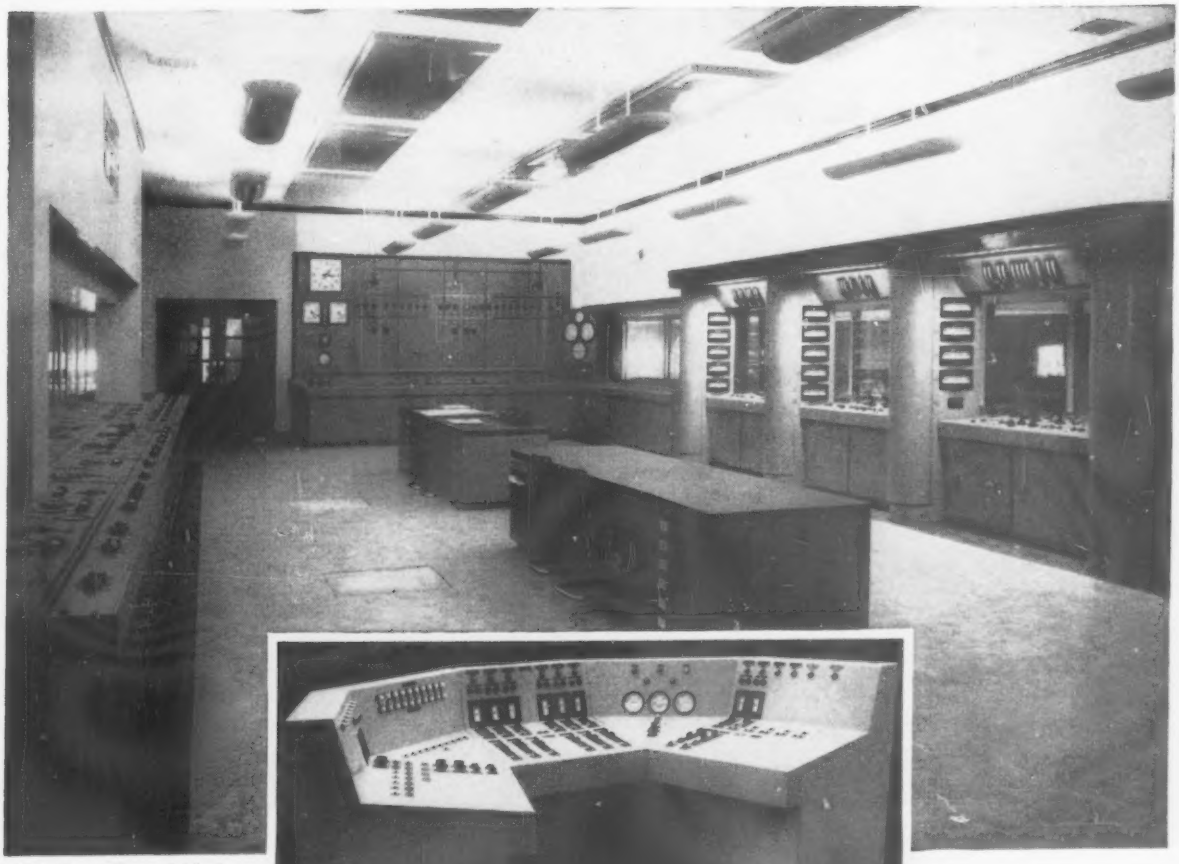

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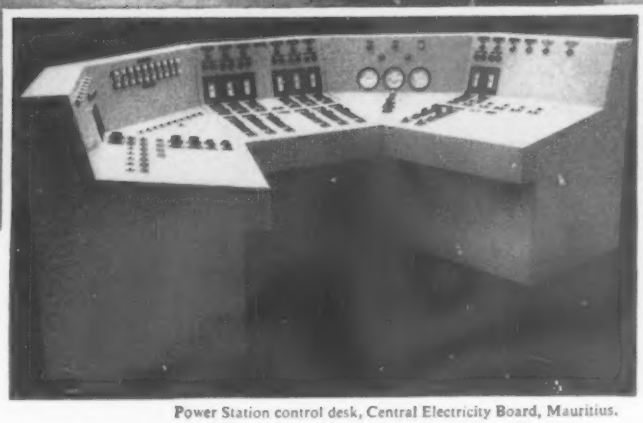

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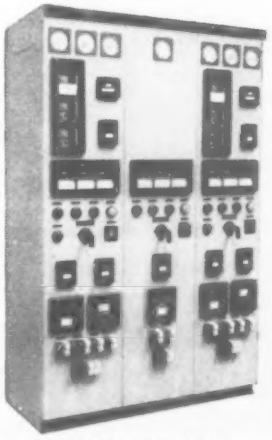

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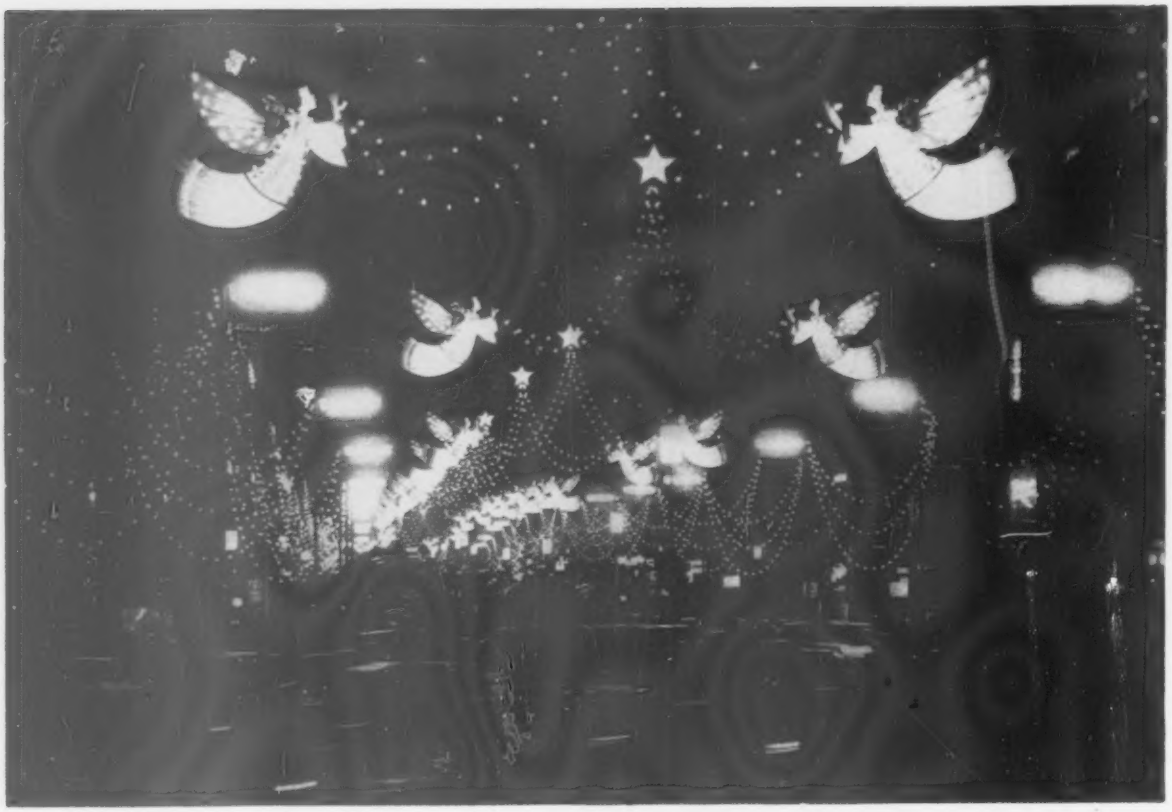

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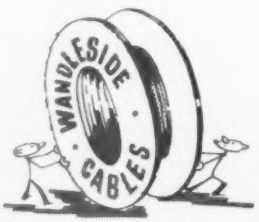

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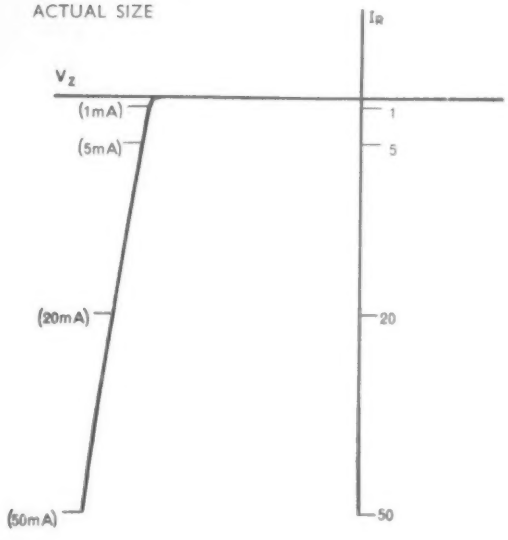

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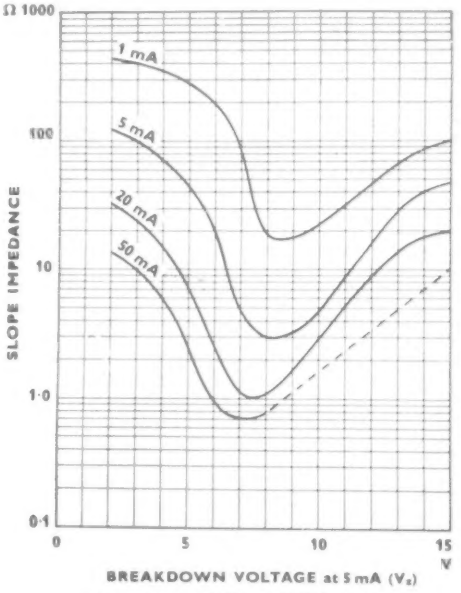

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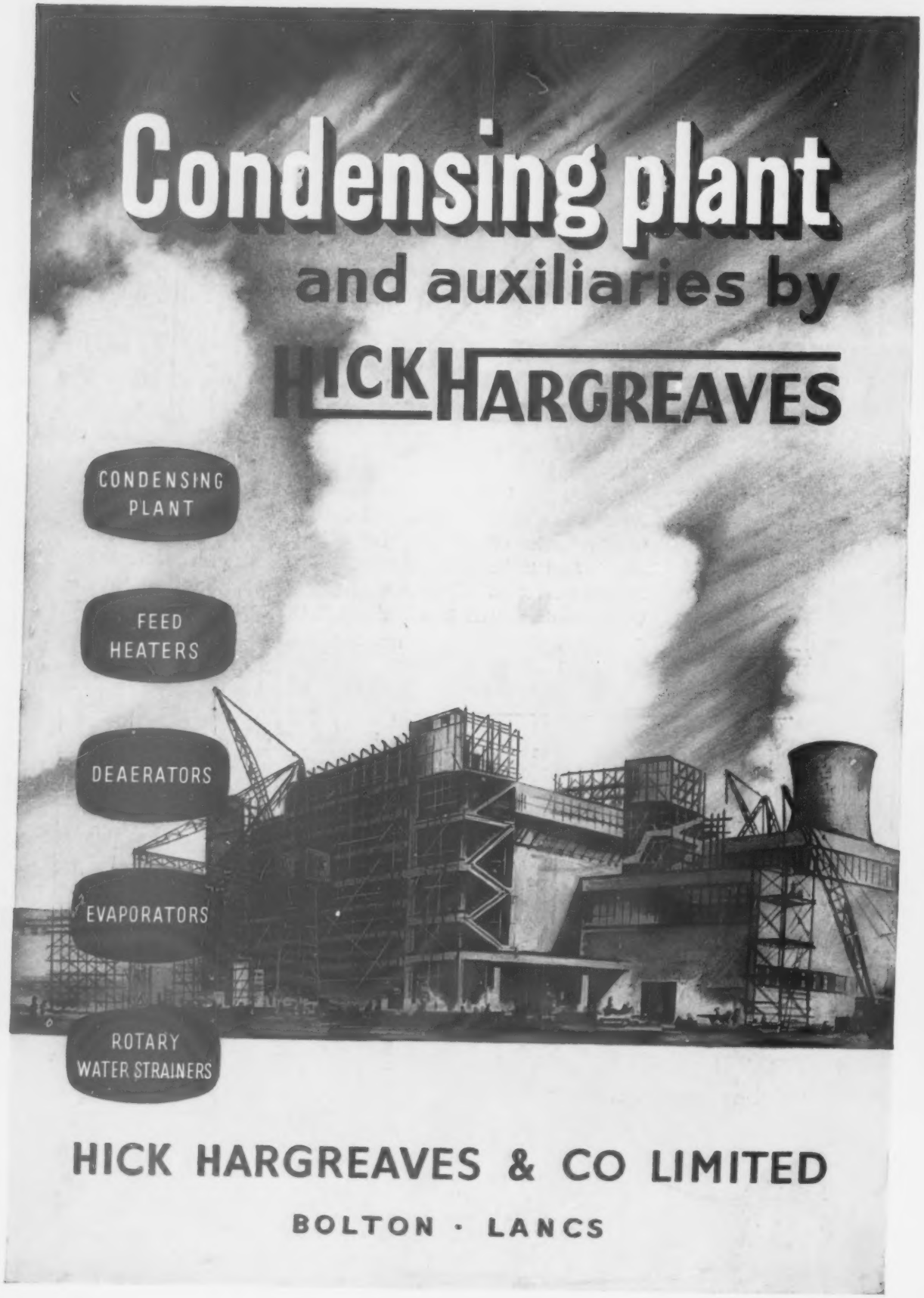
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